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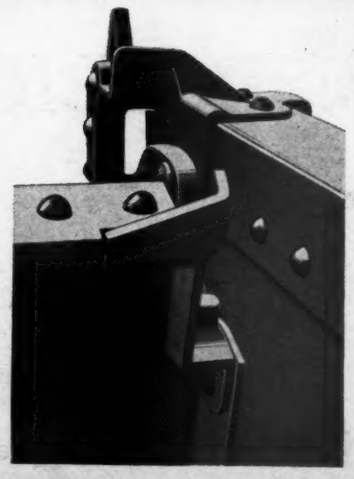

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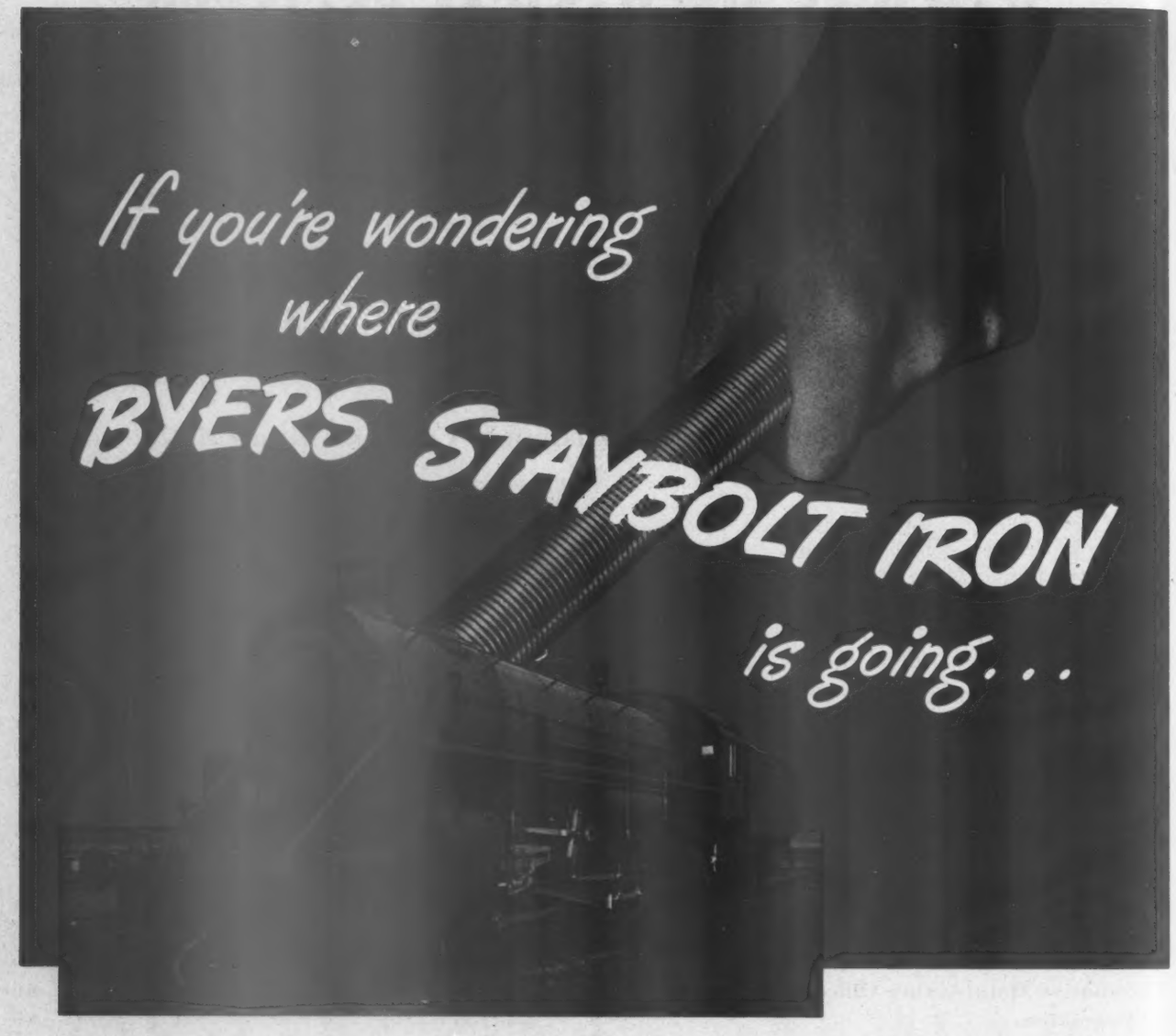

With many war materials, "delivery to destination" doesn't mean just a tide-water port, and with all their miracle-working, this country's railroads can handle only the first leg of the journey.

But three thousand—five thousand—ten thousand miles away, other locomotives, built in United States shops, pick up and finish the job.

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Why Conventions in Print?

Ordinarily it is not good practice to print the same item of information twice in the same issue but this time we're going to take a chance and call your attention to the fact that on September 1, 1942, history was made in the railroad industry. For, on that date, only 6.6 of the locomotives on American railroads were out of service and only 3.1 per cent of the freight cars were "bad order". In August freight locomotives made over 67 million miles and freight cars ran over three billion miles—more than the peaks of 1929. These accomplishments were made possible by American car and locomotive repair forces. They've been working for months to get equipment in shape to make history and they're all set to make some more. These are reasons why the meetings of the four mechanical associations—Car Department Officers', Railway Fuel and Traveling Engineers', Locomotive Maintenance Officers' and Boiler Makers'—were canceled this year. Upon one thing, however, all association members were agreed and that was that the technical knowledge and the interchange of ideas which association work makes possible were needed more than ever this year in the job of running the railroads. So, it was decided that the work of the many committees should go on, even if every member had to consider himself a part of a committee and contribute to the common fund of knowledge and recorded experience. Probably more people had a part in the preparation of committee reports for these associations this year than ever before and their work is done—well done. It is presented in the pages that follow and the secretaries of the associations will welcome your written comment on these reports so that it may be included in the annual proceedings when printed.

Myron C. France, President

F. A. Longo,
Vice-President

A. F. Stiglmeier,
Secretary-Treasurer

Master Boiler Makers' Association

Reports deal with problems of immediate interest to the members—Selection from ten papers on six subjects, prepared for the year book, presented here.

E. R. Battley,
Chief of Motive Power and Car Equipment, Canadian National

◆

D. S. Ellis,
Chief Mechanical Officer,
Chesapeake & Ohio

B. M. Brown,
General Superintendent Motive Power, Southern Pacific

F. K. Mitchell,
Assistant General Superintendent Motive Power and Rolling Stock, N. Y. C.

◆

H. H. Urbach
Mechanical Assistant to Executive Vice-President, C., B. & Q.

Advisory Board Members

THE Master Boiler Makers' Association, in keeping with its long record of continuous constructive work in spite of adverse conditions, has carried through the preparation of an extensive program of committee reports which, because of the inability to hold a meeting this year, will be presented to its members in the usual book of "proceedings." These reports and papers, of which ten have been prepared, deal with the following six topics: Cinder cutting on locomotive boilers; applying and maintaining flues and arch tubes without copper ferrules; chemical treatment of boiler feedwater; a study of defects developing in high-pressure boilers; methods of fabrication of boilers, and material conservation and substitutions in the boiler shop. Abstracts of a selection of these papers are presented here. Other papers will be the subjects of articles in later issues.

Because no meeting of the association is being held this year, there will be no election of officers. The officers elected at the 1941 annual meeting will continue to serve. They are: President, Myron C. France, general boiler foreman, C. St. P., M. & O., St. Paul, Minn.; vice-president, Frank A. Longo, general boiler inspector, So. Pac., Red Wood City, Calif.; secretary-treasurer: A. F. Stiglmeier, general supervisor boilers and welding, N. Y. C., New York.

The members of the Executive Committee whose terms expire in 1944 are Sigurd Christopherson, supervisor of boiler inspection and maintenance, New York, New Haven & Hartford, East Milton, Mass.; R. W. Barrett, chief boiler inspector, Canadian National, Toronto, Ont.; E. H. Gilley, general boiler foreman, Grand Trunk Western, Battle Creek, Mich.

The Executive Board of the Association has adopted a ruling that members of the association in military service shall not be required to pay dues for the duration of the war.

President France's Address

Although we were considerably disheartened by the news that no annual meeting could be held this year, we realized that any feeling that we might have is of small consequence in view of the magnitude of the task at hand.

I can assure you, however, that it has been an unparalleled example of hard work on the part of the several committees, that has made these annual proceedings what they are. To them I owe my thanks for their cooperation. I was astonished by the response I received when I asked for volunteers to serve as committeemen for 1942. We got all we needed and more. Our Canadian brethren responded 100 per cent. I am extremely grateful for the active support given to the committee chairmen so that they could turn in for publication the fine material they have.

Our secretary-treasurer, "Al" Stiglemeier, needs no praise from me to show all of us what hard work, coupled with a natural-born aptitude for organization can do. His work in preparing the questionnaires and compiling the results is his gift to the railroads and to our friends, and we are proud to present the annual proceedings to them.

Also, our friends in the supplymen's association, our associates and officers of the other mechanical associations, the editors and officers of the *Railway Mechanical Engineer* are greatly missed, and it is our hope that we can all meet next year in the fellowship which has characterized our gatherings.

To those of you who have relatives and friends engaged in our armed forces we pray the Almighty for a speedy return home with the fruits of victory. I am sure that the members of our craft are 100 per cent behind them, and I feel sure that as individuals we are exceeding the 10 per cent quota in the purchase of War Bonds and Stamps.

The Prevention of Cinder Cutting in Locomotive Boilers

Individuals quoted on underlying principles — 1938 and 1940 reports deal with practical methods of amelioration

S. A. Fegan,
Chairman

While it is the intention of the Committee on the Prevention of Cinder Cutting in Locomotive Boilers to refrain from using old matter found in previous proceedings it seems imperative in order to abide by this principle that readers of this report refer to the thorough and useful information and sketches set forth in the 1938 and 1940 issues of proceedings which cover practically all the data and methods brought to light from questionnaires received this year, particularly the tonnage and speed at which cinder cutting is effective, the combustion and velocity of gases, and the sketches of remedial practices for dealing with the most general and pronounced points of cinder cutting.

The committee finds that there is practically no new information in the papers received concerning the construction and maintenance of boilers in relation to the elimination of cinder cutting.

Thirty-four questionnaires were received from various railroads, and of these 30 dealing with classes of power from the Mikado the 2-8-8-2 articulated type (all in heavy service) have been considered.

To sum up the comments received, cinder cutting is the result of necessary high firing rates to get maximum capacity out of the locomotive, and is influenced adversely by the use of coal with low heating value, the use of types of superheater units, grates, brick arches and front-end applications that materially obstruct the flow and increase the velocity of gases and unburned fuel.

It is questionable if there is any net savings by changing these appurtenances. Most tests to date have shown their fuel saving value, and some roads have been convinced that the damage from cinder cutting does not justify increasing the fuel bill, or reducing the locomotive capacity, and repairs of cinder cut portions are made at such periods as experience has demonstrated that failures may occur. So far this has proved to be the best method of control.

Our secretary has received a reply to a letter regarding cinder cutting from an authority on drafting, as follows:

The Combustion System

"The problem of combustion in a locomotive is made up of several components. I always like to consider the locomotive boiler as a system insofar as the burning of coal is concerned. This system, when put together, must burn the fuel efficiently and provide ample boiler capacity for the cylinders with the least use of energy from the exhaust steam (lowest possible pressure) and with a steaming margin for the poor fireman and poor grade of coal.

"There are certain limitations that have to be kept in mind. The ash-pan openings shall be such that no fire can escape. The diaphragm, table plate and spark arrester must be arranged to make the front end self cleaning and break up the cinders so they will be ejected from the stack as small harmless particles, these parts to be arranged and proportioned to offer the least resistance to the flow of gases.

"The stack shall be small enough to prevent smoke trailing and the exhaust nozzle of such size as to provide sufficient energy from the exhaust steam to eject and lift the gases of combustion at capacity and light operation.

Cinder Erosion Increases with Firing Rates

"The gas area through the tubes and flues is one part of the system that cannot be altered on present power and presents a problem on new power due to dimensional limitations. This brings us to the problem of cinder cutting. If we consider a locomotive of given gas area through the flues and change any part of the system, we can alter the drafts, but this does not appreciably affect the velocity of gases through the flues at any given firing rate. Gas velocities through the flues are almost entirely dependent upon the amount of coal that is fired and the area through the flues. For each pound of coal fired approximately 11 lb. of air are required. Roughly speaking, if 4,000 lb. of coal are burned per hr., we will have 12 times 4,000 or 48,000 lb. of gas per hr. If 12,000 lb. of coal are fired per hr., we will have 12 times 12,000 or 144,000 lb. of gas per hr. Regardless of the exhaust pressure or draft used to induce the flow of gas through the tubes, the velocity of the gas will depend solely upon the open area through the tubes. Since unburned fuel or cinder loss and gas velocities are proportional to firing rates, cinder erosion will naturally increase with the firing rates.

"In our present freight power using coal from a certain district we are losing up to about 35 per cent of the coal fired in unburned fuel. The greatest part of the unburned fuel is in the form of combustible cinders. If we can cut this unburned fuel loss in half, we will have increased the boiler efficiency considerably, and cinder cutting should no longer be the problem it is today.

"It was thought by the writer that we should cover the entire grate area, or as much of it as is practical, with a brick arch. Such an arrangement should provide radiant heat at high temperature to the entire fire bed. It should prevent a direct draft from the back grates as is now produced with the standard arch arrangement, providing a more equal distribution of the draft over the entire grate surface. It should provide considerably longer burning time for all small particles of fuel being carried in suspension since they would have to reverse their direction of travel at least once before passing to the tubes. The so-called back-head baffle was developed for that purpose.

Better Distribution of Combustion

"It is evident that we are firing too much coal to the center of the firebox with our present standard stoker jet and distributing plates on locomotives. The area along the side sheets in the front two-thirds of the firebox was being starved. Alterations of the stoker jet and distributing plates were made and provided much better fires and apparently bettered the combustion in the firebox. At the completion of the tests the fire held up along the side sheets; this should protect the sheets from cold air. The CO_2 was increased better than one per cent at all firing rates while the evaporation was increased approximately 2,000 lb. per hr. The superheat temperature dropped. From these conditions it is apparent that the heat release in the firebox was increased while the release in the flues was decreased indicating a reduction in unburned fuel being carried into the flues.

"A crown-sheet baffle would increase the burning time above the arch, and would tend to direct and distribute the gas and unburned fuel or cinders before entering the flues. I believe that records would show that the above mentioned locomotive has had less flue plugging and less cinder erosion of flues than other locomotives of this class operating in the same service. The most trouble experienced with this locomotive has probably been the slagging or honeycombing of the flues and the accumulation of slag in the bottom of the combustion chamber. A baffle of brick at the top of the crown sheet will produce honeycomb and slag.

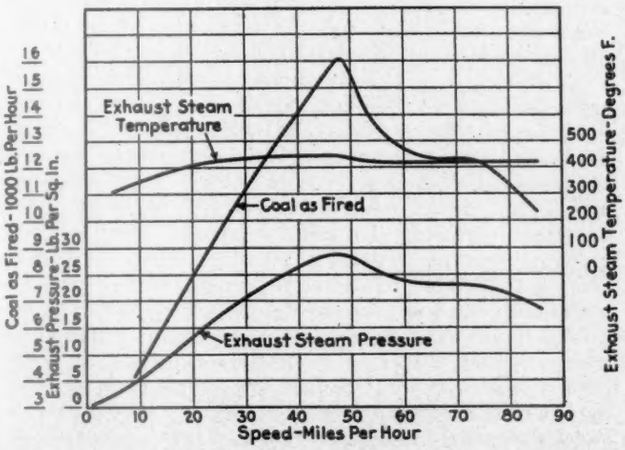
"Experience has shown that fine particles of coal up to ¼ in. in diameter will stick to the plastic surface of the arch brick and burn. They deposit their ash in a molten state on the brick, and since they are so numerous, the molten ash collects quite rapidly and is carried over the arch or off of a brick baffle in the form of small molten drops. These drops will solidify at a temperature of about 1,900 deg., consequently when they strike a comparatively cool surface such as a staybolt head, flue bead, or unit end they cling and cool. Other molten drops of slag constantly build up on the first drops which have wrapped themselves over the flue beads until eventually the flues become entirely coated over and the flue sheet plastered in a solid mass. This accounts for the fact that coals of high ash or slack content produce a great amount of honeycomb.

"The graph sheet illustrates the relation between exhaust-steam pressure, exhaust-steam temperature, coal fired per hour, and locomotive speed as determined during capacity tests. Note that the maximum firing rate or boiler capacity is reached at about 48 m.p.h. At speeds above or below 48 m.p.h. the firing rate is somewhat less. The highest firing rate obtained with full cut-off is about 7,000 lb. of coal per hr. This is less than half the firing rate of about 16,000 lb. per hr. at 48 m.p.h., or at boiler capacity. On one class of locomotive the boiler capacity is reached at about 58 m.p.h. because of the larger diameter of the driving wheels. The graph is based on the maximum drawbar pull at all speeds, and naturally the cut-off required to give the maximum drawbar pull. Part throttle or short cut-off operation would lower the firing rate at any speed.

"This boils down to the fact that cinder cutting is caused by cinders and that a decrease in cinder erosion can only be brought about by reducing their number or reducing their velocity. The reduction of velocity can be obtained by increasing flue areas in larger diameter boilers or through the use of different design of superheaters. This would be an attack of secondary nature, while the primary attack should be made on the production of the cinders themselves."

Open-Type Front Ends Reduces Firebox Erosion

One member of the committee who has made an extensive study of the subject writes in part: "Prior to 1932 we were having considerable cinder cutting in the firebox on flues and staybolts. The old type Master



Relation between exhaust-steam pressure, exhaust-steam temperature, coal fired per hour, and locomotive speed

Mechanics' front end was then in use. The matter of an open-type front end was considered and in 1932 we started to equip our 2-8-2 and 2-8-0 locomotives with the Cyclone front end. All this class locomotives were used, and still are, in freight service. In my experience the open-type front end not only entirely eliminated right-of-way fires but also checked the cinder cutting in fireboxes, for at this time we have no firebox trouble from cinder cutting. This, I believe, is due to the fact that we have a less restricted type front end, thus, decreasing the velocity of the cinders in the firebox and increasing them in the smokebox.

"With this open-type front end we have a great deal of cutting in the smokebox, especially the smoke stack, lift pipe and some rivets in smokebox front door ring. For example, a smoke stack and lift pipe with the open type will last from 14 months to 2 years whereas with old type Master Mechanics' front end a smoke stack and lift pipe would last 8 to 10 years, and some locomotives never had the smoke stack renewed in 20 years. Thus, it has proved here that we have eliminated the cinder cutting from the firebox and taken it to the front end. It is a great deal more economical to replace smoke stacks and lift pipes than flues, sheets, and staybolts. We are getting four years on flues and side sheets, without any trouble from cinder cutting. Locomotive mileage averages 150,000 to 200,000 in this period of four years."

Effect of a Baffle Arch

Another member with recognized experience, dealing with three different types of front ends on the one railroad states in part: "We experience a peculiar condition of cinder cutting on the back flue sheet on one class of our heavy power, 2-8-2 and working pressure of 210 lb. These engines had 239 2¼-in. flues and 45 5½-in. superheater flues. This cinder cutting started at the top of the flue sheet and went down about 18 in. and about 48 in. wide. By removing one brick from the top of the arch we overcome 90 per cent of this cinder cutting. These engines all have Master Mechanics' front-end appliances.

"Our heavy 4-8-4 power, with a working pressure of 250 lb. per sq. in., had considerable cinder cutting on the crown bolts and on both sides of the syphon, about four rows down on each side. This condition was corrected by electric welding a small bar of steel ¼ in. diameter and 2 in. long, ½ in. back of each staybolt head in the cinder cutting area. This application requires about 460 bars of steel. The job was completed about one year ago and since that time I cannot recall of removing a crown bolt or a syphon bolt on account of cinder cutting, although we are renewing some of the bars.

"We have a similar condition on another class of heavy 4-8-2 power with a working pressure of 245 lb. per sq. in. The bars are also electric welded ½ in. back of each bolt head in the cinder-cutting area. A few of this class of power have a baffle brick between the two syphons at the crown sheet near the front of the syphon 12 in. deep. This brick stopped cinder cutting in the center of the crown sheet but had no effect on the right or left sides of the syphons. These engines are equipped with Kiesel front-end appliances."

An honorary member of the Association who contributed an article on this subject in the 1940 Proceedings, which principally dealt with the relation of the proper combustion of fuel to cinder cutting elimination, has contributed a paper in which he deals chiefly with draft control and its possibilities. The following is taken from this paper:

"We all know that cinder cutting is the indirect effect of the front-end draft. The maintenance of adequate boiler pressure is the primary consideration when drafting a locomotive. The detrimental results, such as cinder cutting, have been accepted as a necessary evil and therefore takes secondary place, but it would appear that sufficient draft could be obtained to complete combustion at varying rates without excessively high gas velocity.

"Tests conducted by the University of Illinois led to the conclusion that high draft peaks such as usually occur when a locomotive is started or operated slowly at maximum capacity, have no particular effect on cinder discharge. This theory, however, is to a certain extent contradicted in the moving pictures showing the behaviors of the fuel bed at various rates of combustion. These pictures support the theory that a continuous draft at lower gas velocities causes less disturbance to the fuel bed, and that draft is more a question of the volume of steam discharged from the exhaust nozzle in a given time than of the velocity of jet. If this point is considered tenable, then it would appear that the first steps toward the reduction of cinder cutting should be in the direction of a softer and more continuous draft.

Exhaust Volume Chamber Proposed

"This brings us back to experiments conducted for creating a constant draft by exhausting the steam from the cylinder into what was termed a volume chamber, and from which it passed through the nozzle. While that arrangement functioned, nevertheless there were certain features connected with it that prevented its general adoption, but the underlying principle was sound, and, in my

opinion, has sufficient merit to warrant reconsideration.

"In the majority of present-day locomotives the cylinders, valve chamber, cylinder saddle and frames are usually cast integral. One suggestion for taking advantage of the principles of the Lewis draft appliance would be to make the cylinder saddle a steam-tight chamber, eliminating all exhaust passages so that the steam from the cylinders could be exhausted directly into this chamber and pass from there through the exhaust nozzle.

"As the dimension of this chamber would be equal in capacity to about four cylinder volumes, the exhaust steam, following Boyles law, would be reexpanded in this chamber and its pressure reduced. This would mean a corresponding reduction in the cylinder back pressure and a corresponding increase in the mean effective pressure.

"By using the cylinder saddle as an expansion chamber the volume of steam to be discharged from the exhaust nozzle is not reduced, but as a result of its lower pressure the velocity is reduced. If the doubters still feel that velocity is necessary then, instead of one single-orifice nozzle tip, use four orifices the combined area of which would equal that of the single orifice tip, thus obtaining a higher gas velocity and at the same time an equivalent front-end vacuum with constant flow. This should be the first step and one that is entirely feasible in modern locomotives. The next step would be streamlining the inside of the front end so that all draft currents issuing from the tubes would take a natural flow to the stack instead of impinging against obstructions now placed in the front end for the sole purpose of reducing the size of the cinders.

Get Rid of Jet Action Through the Grates

"The next step would take us to the firebox where cinders originate. Tests too numerous to mention have been made under varying conditions all over the country. In every test it was found that the primary cause of cinder discharge was the lifting action of vertical air jets passing through the grates and the firebed. This would suggest that steps be taken toward reducing or limiting vertical air jets, or, where such expense is considered unwarranted, it would appear that some means could be developed to deliver top or supplementary air in such a way as to counteract the effect of vertical air jets. Even though such means did not entirely eliminate that effect it nevertheless should result in an increased gas turbulence which in turn would increase the efficiency of combustion, resulting in higher temperatures and possibly the complete combustion of the smaller particles of coal before they reach the tube sheet."

Most every master boiler maker is seeking for a device or construction to overcome the high draft velocity, and obtain a constant flow of draft through all sections of tubes and flues, realizing that if this could be accomplished cinder cutting would be overcome.

Until such time as some device is arrived at and generally accepted and adopted, we, as boiler men, are confined to the limit of areas and volume with the present day locomotive construction, and will have to resort to the methods of such prevention as have been mentioned in this and earlier papers to maintain the boiler under the ever increasing demand for greater service.

The committee regrets that all meetings have been cancelled, thereby rendering it impossible to have the customary valuable discussions on the subject.

The report was signed by S. A. Fegan (chairman), district boiler inspector, Canadian National, Toronto, Ont., Canada; H. A. Bell, general boiler inspector, Chicago, Burlington & Quincy, Lincoln, Neb.; R. P. Myers, boiler foreman, Lehigh & Hudson River, Warwick, N. Y.; W. Freischlag, boiler foreman, Wabash, Decatur, Ill.

A Study of Defects in High-Pressure Boilers

Survey of difficulties with respect to 939 boilers on 38 railroads—Ingenious method of seam patching described

E. H. Heidel,
Chairman

High-pressure locomotive boilers operating in fast freight and passenger service have been found to be subject to defects not usually encountered with the older locomotive boilers operating at or near 200 lb. per sq. in. boiler pressure. Defects originating in longitudinal and circumferential seams of boiler shells and firebox sheets have been found in a considerable number of cases. Excessive maintenance of firebox sheets is reported by many railroads; side sheets, throat-sheet diaphragms, throat-sheet ears, syphon barrels and syphon heels requiring renewal after a comparatively short term of service.

The committee has assembled such information on this subject as it has been able to develop with the thought that a discussion of these boiler troubles will be of benefit.

A questionnaire sent out by the secretary resulted in a gratifying number of replies. The principal information developed through this questionnaire is presented briefly in Table I. The 939 boilers involved in the survey were divided as follows: Carbon steel 171, nickel steel 474, and silico-manganese steel 294. Five railroads operating 121 high-pressure boilers (i.e., 250 lb. per sq. in. or higher) with carbon-steel shells reported trouble, as did six railroads operating 368 boilers with nickel-steel shells, and three railroads operating 231 boilers with silico-manganese shells. No information was presented in regard to the number of individual cases of shell trouble, and it will be noted that above 265 lb. per sq. in., all boilers reported were of nickel or silico-manganese steel.

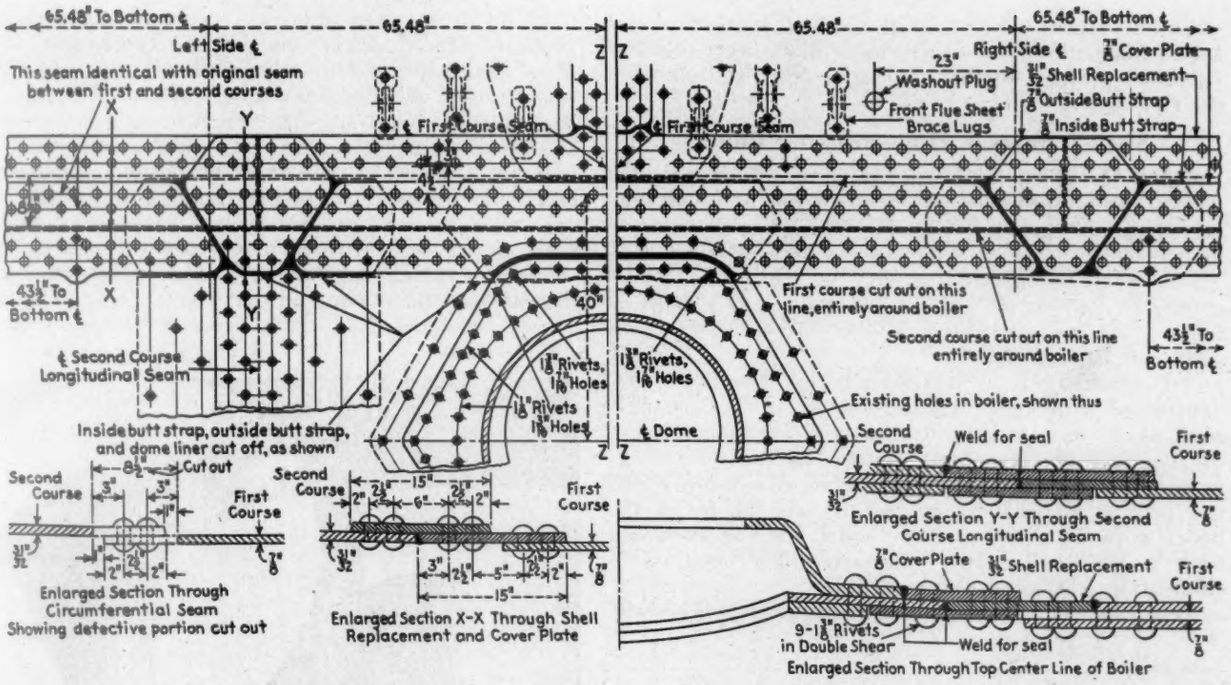

65.48" To Bottom ℄
65.48"
Left Side ℄
This seam identical with original seam between first and second courses
℄ First Course Seam
Right Side ℄
7/8" Cover Plate
23" Washout Plug
31/32" Shell Replacement
7/8" Outside Butt Strap
Front Flue Sheet Brace Lugs
7/8" Inside Butt Strap
43 1/2" To Bottom ℄
℄ Second Course Longitudinal Seam
First course cut out on this line, entirely around boiler
Second course cut out on this line entirely around boiler
1 3/8" Rivets, 1 1/16" Holes
Existing holes in boiler, shown thus
Inside butt strap, outside butt strap, and dome liner cut off, as shown
℄ Dome
Second Course
First Course
Weld for seal
Cut out
Enlarged Section Through Circumferential Seam Showing defective portion cut out
Enlarged Section X-X Through Shell Replacement and Cover Plate
Enlarged Section Y-Y Through Second Course Longitudinal Seam
9-1 3/8" Rivets in Double Shear
Enlarged Section Through Top Center Line of Boiler

Fig. 1—A method of replacing a defective circumferential seam between the first and second boiler courses

The committee does not wish to draw any conclusions from such a limited amount of data other than to point out that riveted-seam failures occur above 250 lb. per sq. in. boiler pressure in boilers of carbon steel, nickel steel and silico-manganese steel. Higher pressures and larger boilers mean greater expansion and contraction in the firing up and cooling down periods, and where two or three sheets are connected by rivets the time element must be considered when the boiler is heated up or cooled off to prevent excessive strains on rivets and sheets. This difficulty would not be encountered when single sheets are used, as would be the case with a welded boiler shell. It is suggested that locomotive boilers of the conventional design and size for pressures above 250 lb. per sq. in. are beyond the scope of riveted design.

Experience with defective seams in high-pressure boiler shells indicates that fine cracks develop in rivet holes, usually in the circumferential seams. In the early stages these cracks are discernible only with a magnifying glass after the rivet has been removed. These cracks, which appear to be both inter-crystalline and trans-crystalline, progress until the crack extends from rivet hole to calking edge, or to an adjacent rivet hole, or into the solid plate and leakage results, which in most cases is the first indication that a defect has developed. Investigation usually indicates the existence of a considerable number of defects in addition to those at which leakage is evident, other seams in the boiler being attacked. Seams have been observed where no cracking was evident from inside or outside of the boiler, but

Table I—Results of Questionnaire on Defects in High-Pressure Boilers

Railroad	No. of Locomotives at 250 lb. per sq. in. or higher	Maximum boiler pressure, lb.	Material of boiler-shell sheets	Has trouble been experienced	Nature of trouble
A	65	265	Nickel steel	No	.....
B	50	300	Silico-manganese	Yes	Failure of riveted seams
C	25	300	Nickel steel	Yes	Cracking in third course over No. 2 cylinder saddle
D	None	210	Carbon steel	Yes	Cracks at front waist sheet
E	177	300	Nickel steel	Yes	Cracking in riveted seams
F	50	250	Carbon steel	No	.....
G	37	310	Nickel steel	Yes	Rivets failing, and plate cracking in rivet segments
H	None	200	Carbon steel	No	.....
I	66	260	Silico-manganese	Yes	Cracking in circumferential seams
J	None	200	Carbon steel	No	.....
K	Not reported	250	Carbon steel	Yes	Flues, back tube sheets and side sheets give trouble
L	30	285	Nickel steel	No	.....
M	None	220	Carbon steel	No	.....
N	11	250	Nickel steel	No	.....
O	Not reported	250	Carbon steel	Yes	Cracks at circumferential seams
P	20	285	Silico-manganese	No	.....
Q	None	215	Carbon steel	No	.....
R	75	250	Nickel steel	Yes	Cracks in circumferential seam, first and second course
S	None	245	Carbon steel	Yes	Staybolt leakage
T	31	275	Silico-manganese	No	.....
U	51	265	Carbon steel	Yes	Cracks at throat sheet and end of waist sheet
V	10	260	Nickel steel	Yes	Cracks from boiler-check holes
W	None	210	Carbon steel	No	.....
X	12	250	Silico-manganese	No	.....
Y	Not reported	250	Carbon steel	No	.....
Z	44	300	Nickel steel	Yes	Cracks at rivet holes in shell and wrapper sheet seams
AA	None	220	Carbon steel	No	.....
BB	Not reported	250	Silico-manganese	No	.....
CC	None	225	Carbon steel	No	.....
DD	115	300	Silico-manganese	Yes	Cracks from rivet holes in shell courses
EE	None	220	Carbon steel	No	.....
FF	None	240	Carbon steel	Yes	Cracking at circumferential seams
GG	65	250	Carbon steel	Yes	Cracks at outside throat sheet
HH	None	245	Carbon steel	Yes	Cracking at riveted joints
II	None	200	Carbon steel	No	.....
JJ	None	200	Carbon steel	No	.....
KK	5	250	Carbon steel	Yes	Cracking at throat sheet and wrapper sheet

when butt straps were removed and both butt straps and sheets Magnafluxed, the sheet faces which were together exhibited a large number of cracks radiating out from the rivet holes.

Shell Defects in High-Pressure Boilers

Table II, which follows, gives a record of the shell defects in high-pressure boilers occurring in a two-year period on one railroad operating 50 high-pressure locomotive boilers. All of these boilers were of silico-manganese steel, 40 operating at 285 lb. per sq. in. and 10 at 300 lb. per sq. in. These locomotives were built as follows: Two in 1935, one in 1936, 15 in 1937, 22 in 1938 and 10 in 1940.

A study of Table II, representing less than two years' experience with high-pressure boilers on this one railroad, would seem to indicate that the conventional design of riveted boiler is not satisfactory for the service expected of these locomotives. Another conclusion which has become increasingly evident is that the better the boiler work on a high-pressure boiler, the less likelihood there is that shell failure will occur. The necessity of eliminating leakage is also evident.

Repairing seam failures in large-diameter boiler shells of 1 in. or more in thickness presents a considerable problem. It is not unusual to find cracks from rivet holes in the second-course longitudinal seam, and at the same time in the circumferential seams at the front and back ends of this course, the cracks being found in first-, second- and third-course sheets. In a case of this kind it is not possible to reproduce the original construction exactly as the new course must extend ahead and back onto good material in the adjacent courses. Complications invariably occur where the new construction encounters existing longitudinal seams, waist-sheet reinforcements, and other stud and rivet holes. The difficulties encountered in replacing a defective circumferential seam between the first and second boiler courses is shown in Fig. 1. The importance of eliminating leakage as far as possible makes it necessary to use electric welding, and care must be constantly exercised to see that the boiler stresses are carried by the usual riveted construction. It is recognized, of course, that repairs of this kind are of a more or less temporary nature, but it is imperative that these modern locomotives be returned to service as quickly as possible, particularly in these times, and it might be pointed out that repairs of this nature have, in a number of cases, been in service now longer than the original construction.

Fig. 2—Typical pressed-steel standard patches for boilers

Considerable difficulty has been experienced with firebox sheets in high-pressure, high-capacity boilers. One case was reported where new locomotives equipped with side boiler checks, feedwater heaters and syphons experienced leaking staybolts and blistered arch tubes during the first month the locomotives were in service. Investigation pointed to the possibility that feedwater from the heater was drawn back rapidly to the side-sheet water space by the high rate of circulation. The boiler check was relocated on top of the first boiler course, after which a very noticeable decrease in staybolt leakage was evident. As a consequence the boiler checks on

Table II—Defects in High-Pressure Boilers

Locomotive	Date built	Type	Boiler pressure, lb.	Date of shell failure and mileage	Nature of defect
(a)....	Sept., 1938	4-6-4	300	Nov. 25, 1940—281,179	Circumferential seam, first and second courses, cut out and renewed, 110 in. long
(b)...	Feb., 1938	4-8-4	285	Jan. 17, 1941—285,959	Entire circumferential seam, first and second courses, cut out and renewed
(c)...	Nov., 1937	4-8-4	285	Feb. 21, 1941—281,065	Wrapper-sheet longitudinal seam, right side, cracked 40 in. long
(d)...	May, 1936	4-4-2	300	May 19, 1941—548,130	Longitudinal seam, second course, cracked 30 in. long
(e)....	Aug., 1938	4-6-4	300	June 10, 1941—370,762	Entire circumferential seams, first and second courses, and second and third courses, cut out and renewed
(f)....	Aug., 1938	4-6-4	300	June 14, 1941—375,732	Entire circumferential seams, first and second courses, and second and third courses, cut out and renewed
(g)...	April, 1938	4-8-4	285	July 3, 1941—314,640	Top half of second course, longitudinal seam and circumferential seam, first and second courses, renewed
(h)...	Sept., 1938	4-6-4	300	July 30, 1941—374,878	Circumferential seam, first and second courses, cut out and renewed 110 in. long
(i)....	Aug., 1938	4-6-4	300	Aug. 27, 1941—407,025	Circumferential seam, first and second courses, patched
(j)....	May, 1935	4-4-2	300	Oct. 22, 1941—766,746	Entire longitudinal seam, second course, cut out and renewed
(k)...	Sept., 1938	4-6-4	300	Nov. 8, 1941—422,816	Circumferential seam, first and second courses, cut out and renewed 220 in.
(l)....	Dec., 1937	4-8-4	285	Nov. 12, 1941—353,404	Entire second course, including circumferential seam, first and third courses, renewed
(a)*...	Sept., 1938	4-6-4	300	Nov. 24, 1941—422,906	Additional cracks in circumferential seam, first and second courses, patched
(m)...	April, 1937	4-4-2	300	Dec. 19, 1941—544,169	Top half of first course and circumferential seam, first and second courses, renewed
(n)...	Nov., 1937	4-8-4	285	Jan. 13, 1942—360,930	Wrapper-sheet longitudinal seam, right side, cracked 40 in. long
(d)*..	May, 1936	4-4-2	300	Feb. 14, 1942—654,000	Throat sheet cracked on right and left sides
(o)...	Dec., 1937	4-8-4	285	March 1, 1942—393,283	Wrapper-sheet connection seam cracked
(p)...	Jan., 1938	4-8-4	285	March 18, 1942—383,800	Wrapper-sheet connection seam cracked
(q)...	March, 1940	4-8-4	285	June 1, 1942—182,500	Longitudinal seam, third course, and circumferential seam, second and third courses, renewed
(l)*...	Aug., 1938	4-6-4	300	Aug. 7, 1942—536,300	Additional cracks in circumferential seam, first and second courses, patched
(k)*..	Sept., 1938	4-6-4	300	Sept. 1, 1942—537,200	Entire circumferential seam, second and third courses, cut out and renewed

*Second failure.

the remaining engines of this class were relocated on the top of the boiler. Side sheets on these engines were all renewed during the first six months of service, but there was no staybolt leakage after renewal of the sheets and relocation of the boiler checks, and six years' service was obtained from the new sheets.

The early and frequent renewal of throat sheet ears, diaphragm plates and syphon snub noses has led in some instances to standard patches being developed for these parts, these patches being made quickly and cheaply under the hydraulic press. Examples of these pressings are shown in Fig. 2. The use of molybdenum steel for firebox sheets is reported to have caused a marked increase in the life of the sheets.

Replies to the questionnaire indicated that a majority of the members favored a wide water space at the foundation ring, large radii at the corners, and that advantage should be taken of every means available to improve the circulation. It is also thought that too little attention has been given to the drafting of large locomotives, and that the arch design might be altered to permit a more uniform temperature throughout the firebox, so that the highest temperature will not be confined to that part of the firebox having the least amount of water on the fire sheets. It is felt that these large high-pressure boilers should not involve any unusual requirements in the fire box except to maintain terminal temperatures as near normal as possible. It is imperative that sufficient time be allowed at washout periods to permit normal expansion and contraction of the boilers when being cooled down or heated up.

In conclusion the committee feels that considerable thought and study must still be devoted to the design, construction, operation and maintenance of modern steam locomotives. The results to date seem to indicate that for pressures over 250 lb. per sq. in., the conventional riveted design is not satisfactory. As practically all shell defects originate in rivet holes of riveted seams, welded construction whereby the riveted seams would be eliminated should be given serious consideration. Better workmanship is required in building and maintaining high-pressure boilers than was necessary in the older 200 lb. boilers. Stress relieving of the shell sheets after rolling should be practiced for either riveted or welded construction.

The report was signed by E. H. Heidel (chairman), general boiler foreman, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; F. A. Longo, general boiler inspector, Southern Pacific, San Francisco, Calif.; E. H. Gilley, assistant boiler foreman, Grand Trunk, Battle Creek, Mich.; L. R. Haase, master mechanic, Baltimore & Ohio Chicago Terminal, Chicago; E. E. Owens, general boiler inspector, Union Pacific, Omaha, Neb.; Frank Yochem, general boiler inspector, Missouri Pacific, St. Louis, Mo.; H. Mehling, boiler foreman, Duluth, Missabe & Iron Range, West Duluth, Minn., and O. H. Kobernick, general boiler inspector, New York, Chicago & St. Louis, Conneaut, Ohio.

Application and Maintenance of Flues and Tubes

A study of the methods used on a number of railroads, together with performance data

Sacchi

S. G. Longo, Chairman

Last year it was decided to make a further study of this subject. A questionnaire was therefore sent to boiler men in the United States, which was confined to present day locomotives.

We found a difference of opinion and, therefore, prepared our report to present the practice in effect on the majority of railroads. Some will not agree with our findings. There is a difference of opinion among practical men in the boiler field regarding the methods used in cleaning, safe-end welding and testing of flues and tubes preparatory to applying to the boiler.

The life of flues and tubes depends entirely on the type of locomotive and the service. On some the full four years' service is obtained with a possibility of an extra year extension. On others of the same type of locomotive, where the boiler water is not being treated, flues and tubes are required to be renewed in two and three years, because of improper water circulation on account of the accumulation of mud and scale causing pitting and also fire cracking.

Before the flues and tubes are applied, all the holes in the tube sheets are to be reamed smooth and true. The burrs must be removed from the edge of the holes on both sides of the sheet and rounded off to $\frac{1}{16}$ in. radius. The tube sheets must be straight before the flues or tubes are applied. "Strong-backs" should be used if necessary to straighten the sheets. But, strong backs must be removed before the flues or tubes are applied. If the sheet will not remain straight it should be reheated and straightened to avoid unnecessary strain on the flues or tubes. The flues and tubes must be straight before being placed in the boiler, the ends cut off square and annealed, free from burrs. Also file or grind off all scale.

All the tube holes in the new back tube sheets are drilled 2 in. and 2¼ in. in diameter for 2-in. and 2¼-in. tubes, $3\frac{1}{32}$ in. in diameter for the swaged end of the 3½-in. superheater flue, and $4\frac{17}{32}$ in. in diameter hole for the swaged end of the 5⅜-in. and 5½-in. superheater flue. The front tube sheet holes are drilled $\frac{1}{16}$ in. larger in diameter of the tube and flue.

The 2-in. and 2¼-in. tubes are heated hot and swaged. Most railroads prefer a straight swage and others a taper swage ⅛ in. smaller in diameter, allowing for the application of the copper ferrules as shown in Fig. 1.

The 3½ in. diameter flues are swaged to 3 in. diameter, and the 5⅜ in. and 5½ in. diameter flues are swaged to 4½ in. diameter. Some railroads are applying the large flues as mentioned in the above, with copper ferrules in the back tube sheet and beading them while others are applying them without copper ferrules and electric welding them as shown in Fig. 4 with very good success.

Note:-
Tube sheets must be straight before tubes are applied, and tubes must be straight before being placed in boiler. Holes in sheets to be carefully cleaned.
Ends of tubes must be cut off square free from burrs, also file or grind off all scale.
For the size, thickness, length and number of tubes and superheater flues applicable, see drawing entitled "Boiler Tubes"

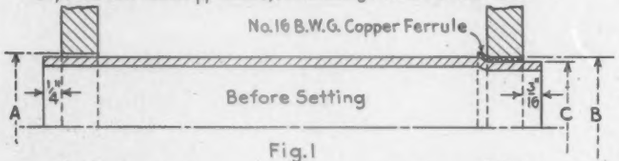


Fig. 1

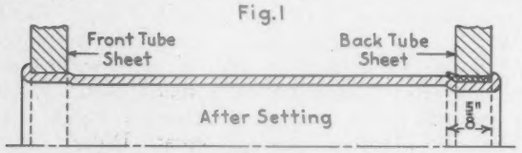


Fig. 2

Size of Tube	Front Tube Sheet	Back Tube Sheet	
	Dia. of Hole A	Dia. of Hole B	Dia. of Swedge C
2" Dia.	2 1/16"	2"	1 7/8"
2¼" Dia.	2 3/16"	2¼"	2 1/8"

Note:-
All tubes rolled in front tube sheet of which 20% are to be beaded over.
All tubes to be set in back tube sheet with copper ferrules and beaded over. Ferrules to be rolled in hole before tube is inserted.

Setting of 2" and 2¼" Tubes

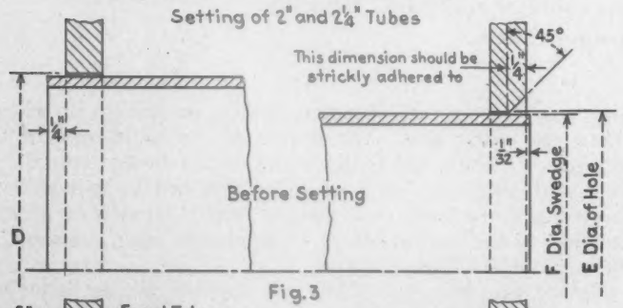


Fig. 3

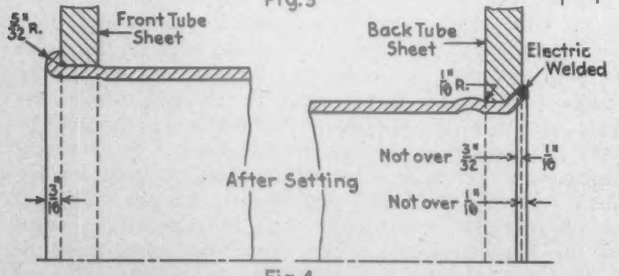


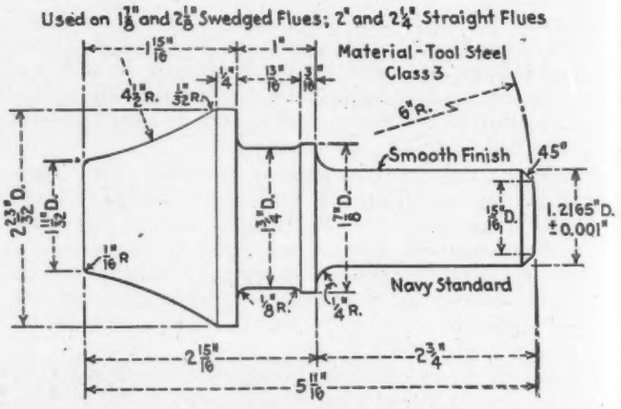
Fig. 4

Size of Flue	Front Tube Sheet	Back Tube Sheet	
	Dia. of Hole D	Dia. of Hole E	Dia. of Swedge F
5⅜" Dia.	5 7/16"	4 13/32"	4½"
5½" Dia.	5 9/16"	4 17/32"	4½"
3½" Dia.	3 9/16"	3 1/32"	3"

Note:-
All flues to be rolled and beaded over in front tube sheet. In back tube sheet, flues to be so rolled, prossered and countersunk that flue will be set snugly without cutting into back surface of tube sheet. Flue must be examined for tightness before being welded which must be done by the electric process.

Setting of 3½", 5⅜" and 5½" Superheater Flues

Figs. 1-4—Various methods of applying tubes and flues with and without copper ferrules in the back tube sheet


Used on 1⅜" and 2⅛" Swedged Flues; 2" and 2¼" Straight Flues
Material - Tool Steel Class 3
6" R.
Smooth Finish
45°
Navy Standard
1.2165" D. ±0.001"
Fig. 5—Boiler-tube belling tool

The 2-in. and 2¼-in. tubes are applied with copper ferrules in the back tube sheet, as shown in Fig. 1, using 1/16 in. or .065 in. thickness of copper in the new back tube sheet. The copper ferrule is set back in the hole 1/32 in. from the fire side of the tube sheet, and lightly rolled in the hole by use of an air motor and self-feeding rolls, or with the use of blind expander to insure a snug fit for the entrance of the tube in the back tube sheet. The copper ferrules should be belled out on the water side of the back tube sheet by using a hand belling tool and hand hammer before the tubes are applied.

The boiler must be thoroughly clean. The tubes are then applied and set 3/16 in. long in the firebox for a bead either by lipping or pinning the end of the tube in the hole, care being taken not to batter the end of the tubes. They are then belled out by the use of a pneumatic belling tool, as shown in Fig. 5. When using the sectional expander (in Fig. 6) drive the pin in until it is fairly solid, then draw the pin out and give the expander a turn equal to half a section, then drive the pin in again. The expander should be turned at least three times during the operation, using a No. 60 or No. 90 air riveting hammer.

Expanding in Rolling Tubes

When expanding, or prossering tubes the center rows of tubes should be expanded first and working out on either side toward the outside rows of tubes, so as to create an equal expansion of the back tube sheet. The tubes should always be rolled and fastened in the front tube sheet before they are beaded in the back tube sheet.

All tubes are rolled tight in the front tube sheet by the use of an air motor and self-feeding rolls, of which 20 per cent are beaded to support and keep the tube sheet straight throughout.

The tubes are then beaded at the back tube sheet with what we call a No. 1 beading tool, as shown in Fig. 7. Fig. 1 shows the initial application of tubes in a new front and back tube sheet. Note that the copper ferrule is set back in the tube hole 1/32 in. from the fire side of the tube sheet, so it will not be exposed under the bead after the end of the tube has been beaded over.

After a locomotive in which the tubes have been reset has been fired up and tested out, and the firebox is cool enough to enter, all the tubes should be given a very light rolling and rebeaded, and cut off what fins may have developed, sand blasted and electric welded around the bead as shown in Fig. 8 using a 1/8-in. coated welding rod, straight polarity.

Most railroads prefer that the boiler be empty of water when welding tubes. In electric welding the tube beads the operator should start at the top center, lightly

at first, welding around to the bottom center and return, overlapping the weld at both the top and bottom center. The welding of tubes can be started at either side of the tube sheet by first starting on the top or bottom tube, welding each row vertically and continuing on across the entire back tube sheet, without warping the back tube sheet.

The application of flues as shown in Figs. 3 and 4 have been used with success on the Southern Pacific since

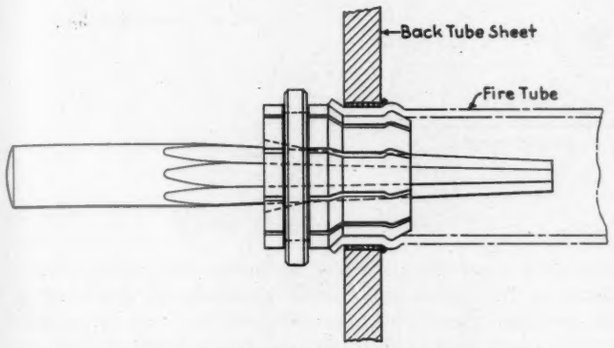


Fig. 6—The use of the sectional expander

panding tubes with a No. 60 or No. 90 air riveting hammer.

The flue is then set against the countersink by the use of a pneumatic fork tool, or a heavy fuller tool. Each flue is chipped on a 45 deg. angle opposite the angle of countersink in the back tube sheet as shown in Fig. 4, ⅛ in. deep from the face of the back tube sheet forming a perfect 90 deg. angle.

Any accumulation of oil or grit on the end of the flue, or in countersink of the back tube sheet, should be burned off by using an acetylene torch with a No. 12 welding tip, heating around the end of each flue where it is to be welded by making one circular pass taking each row vertically and starting at either side, care being taken not to overheat the back tube sheet.

The flue is electric welded to the back tube sheet with ⅛ in. or 5/32 in. coated welding rod, straight polarity. Starting at the top center, lightly at first, welding around to the bottom center, and return, overlapping the weld at both top and bottom centers, care being taken to prevent the weld from projecting too far out beyond the back tube sheet in the firebox. The welding of flues may be started at either side of the back tube sheet, welding each row vertically and continuing on across the entire back tube sheet, with the boiler empty.

In the front tube sheet flues are rolled with an air

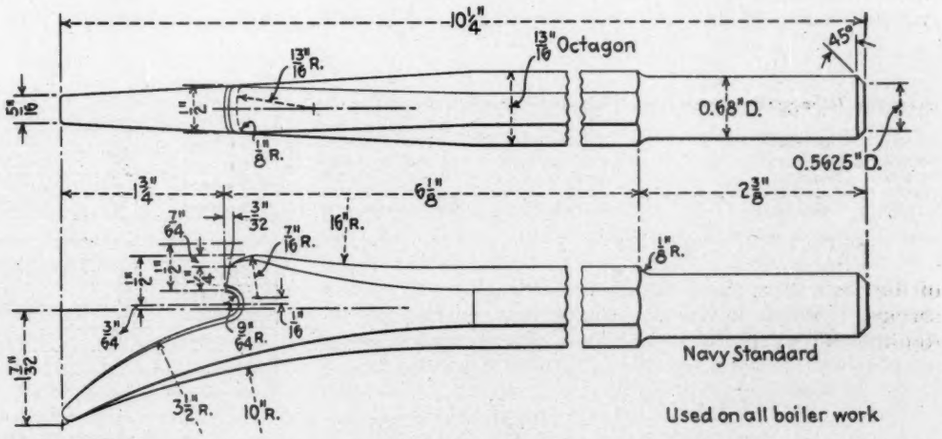


Fig. 7—No. 1 beading tool for fire tubes

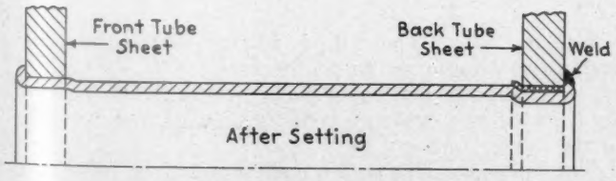


Fig. 8—Bead at the back tube sheet as welded after the locomotive has been fired up and tested

1926. Note that copper ferrules are not used in the back tube sheet in the application of superheater flues.

Application of Superheater Flues

All superheater flue holes in the back tube sheet are countersunk ¼ in. deep, or one-half the thickness of the back tube sheet and countersunk at a 45 deg. angle as shown in Fig. 3. This is done on a drill press after the flue holes have been drilled to size.

The superheater flues are set 1/32 in. long from the surface of the tube sheet on the fire side as shown in Fig. 3, the end of which is lipped over into countersink. The flue is then rolled tight in the back tube sheet by the use of air motor and self-feeding rolls and expanded three times. Follow the same procedure as when ex-

motor and self-feeding rolls, belled out and beaded over with a No. 4 beading tool (Fig. 9).

When it becomes necessary to renew set of tubes and the tube holes in the back sheet have become enlarged to ⅛ in. over original diameter, a new back tube sheet should be applied.

In resetting the tubes or making repairs, tube holes in the back tube sheet should be reamed out to one true diameter, and burrs removed from the edge of the hole on both sides of the tube sheet. Copper ferrules of varying thicknesses (Fig. 10) are applied to compensate for the enlargement of the tube hole to suit the tube.

When the tube holes in the front tube sheet are found slightly enlarged, the tubes should be shimmed tight with black or jacket-iron shims of proper thicknesses (Fig. 11). The tubes should then be rolled in the front tube sheet with proper diameter self-feeding rolls, care being taken to prevent rolling too severely as this will thin out the tube walls and may result in a failure.

Leaky tubes should be tightened with sectional expanders and rebeaded with a beading tool. Care should be taken not to expand tubes too hard with expander, and not to touch the sheet with the beading tool. Excessive expanding destroys the tube and tube sheet. Constant use of the beading tool tends to wear out the

bead and grooves the tube sheet. Therefore, these tools should not be used unless necessary. When leaks develop in welded tubes or flues, the old weld should be chipped away, the tube reworked, sand-blasted, and rewelded.

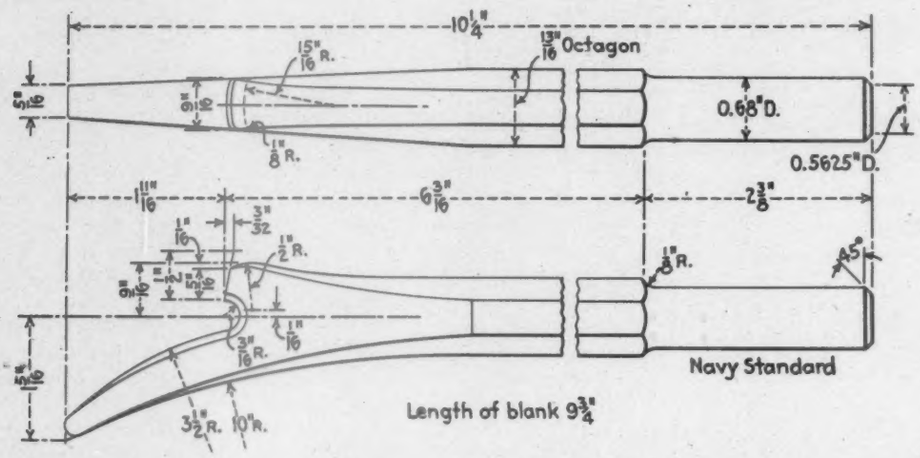


Fig. 9—Beading tool for use on superheater flues

Life of Boiler Sheets

We find that the average life of the back tube sheet in the combustion chamber type boiler, is about eight years, which usually requires a patch across the top knuckle of the back tube sheet during the first 12 to 18 months service. When horizontal cracks first develop in the top knuckle of the back tube sheet, due to the expansion and contraction, and the continual bending movement localized at this point, they are chipped out and electric welded with a single vee weld inside the firebox.

Average Mileage Between Resetting of Flues—Southern Pacific

Type	Service	Miles per month	Mileage between resetting of flues
2-10-2	Freight	4,000 to 5,000	192,000 to 240,000
4-10-2	Freight	4,000 to 5,000	192,000 to 240,000
4-8-8-2	Frt. & Pass.	6,000 to 8,500	288,000 to 408,000
4-8-2	Passenger	8,000 to 10,000	384,000 to 480,000

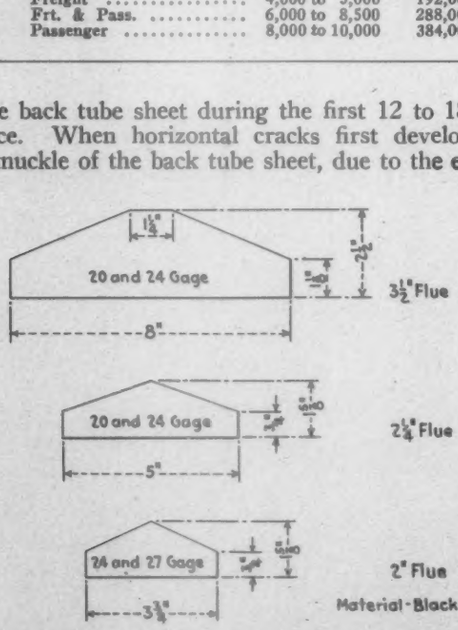


Fig. 11—Tube shims for use with enlarged front tube-sheet holes

At the first shopping a narrow straight horizontal single vee, reinforced on the back butt welded patch taking in the top row of tubes, is applied and increased in size for each renewal of top knuckle back tube sheet patch when necessary.

After two years service many railroads renew the two bottom rows of tubes or flues at the bottom of the tube sheet on combustion-chamber type boilers because the long tubes and flues sagging at the center concentrate a stress at the front tube sheet resulting in grooving at the bottom side of the tube next to the front tube sheet on the water side. To overcome this sagging and grooving of the bottom row of tubes at the front tube sheet, a 1/16-in. by 2-in. by 4-in. black iron shim may be applied underneath the tube in the front tube sheet before rolling the tube. The shim is scarfed on the 2-in. ends and rolled lengthwise to fit the tube.

Diameter of Flue	Inside Dia. of Ferrule	Thickness of Ferrule Dim. T	Length L
2" Swedged	1 5/8"	0.065"	5/8"
2" Swedged	1 5/8"	0.075"	5/8"
2" Swedged	1 5/8"	0.085"	5/8"
2" Swedged	1 5/8"	0.095"	5/8"
2¼" Swedged	2 1/8"	0.065"	5/8"
2¼" Swedged	2 1/8"	0.075"	5/8"
2¼" Swedged	2 1/8"	0.085"	5/8"
2¼" Swedged	2 1/8"	0.095"	5/8"

Fig. 10—Copper ferrules for 2-in. and 2¼-in. tubes

On smaller boilers tubes are renewed in the form of an inverted vee, making it easier to wash out the belly of the boiler.

The mileage a locomotive makes should be considered in estimating the life of tubes and flues. The elimination of pitting or grooving of tubes and flues is still a problem. However, the treatment of boiler water has reduced the tendency to pit.

The degree of clealiness and attention to maintenance is the principal factor in eliminating premature repairs.

The report was signed by S. G. Longo (chairman), assistant general boiler foreman, Southern Pacific, Los Angeles, Calif.; S. Christopherson (vice chairman), supervisor boiler inspection and maintenance, New York, New Haven & Hartford, E. Milton, Mass.; W. W. Funk, boiler foreman, Chesapeake & Ohio, Hinton, W. Va.; S. S. McConnell, general boiler foreman, Erie, Hornell, N. Y.; E. G. Staneiforth, general boiler foreman, Chicago, Burlington & Quincy, Denver, Colo.; J. M. Stoner, supervisor of boilers, New York Central, New York Central, Cleveland, Ohio, and C. E. Bodine, general boiler foreman, Missouri Pacific, Sedalia, Mo.

Substitution and Conservation of Materials

The committee offers thirteen specific suggestions for extending the life of critical materials, including new uses for scrap

E. H. Gilley,
Chairman

A majority of the materials involved in the fabrication and repair of locomotive boilers and tenders have been placed on the critical materials list by the War Production Board and as the demand for other materials increases a still further reduction may be expected in the amount and perhaps in the quality of the materials. We are at the present time limited as to the sizes of tank steel to be rolled by the mills. This will require the extensive use of welding in the building of new and repairing of old tenders and will materially increase the cost of repairs. It is quite possible that the size limit on plates will be extended to include flange and firebox steels.

Some of our railroads have utilized various alloy steels in locomotive boilers. These alloys are now available only for certain types of war materials and it will be necessary that those railroads make use of other materials for repairs. In addition to the substitution in material, the engineering departments will be called upon to devise means of using the materials available and making repairs to conform to the original factor of safety.

The utilization of the materials available on the railroad is largely a matter for each individual railroad to cope with. Some railroads may have a substantial quantity of materials on hand to enable them to carry through the emergency; others are not so fortunate. It would seem plausible and perhaps will be necessary for the railroads to exchange materials among themselves to enable all to operate to their fullest extent.

Supervisors will be called upon to exert their resourcefulness to the utmost, because when we save material we usually require additional labor either to make over or repair the parts involved in the saving. Personal inspection and consultation with all supervisors should determine if the period of service can be extended with safety or if it would be more economical to renew or repair the part involved. Where definite standards of repairs are established by maintenance regulations, it may be necessary to alter or amend the regulations during the period of the emergency.

Information compiled from the questionnaires indicates that, while no apparent shortage of materials is now being experienced, it is anticipated in the near future and provision is being made by all concerned to meet the emergency. The committee presents the following suggestions as worthy of consideration and trial by the Association members.

Specific Suggestions for Saving Critical Materials

Copper—The elimination of copper ferrels in flue and tube application will be covered in another topic. It is felt that the use of non-copper-bearing tank steel will increase tender pitting and corrosion and that tender interiors and coal spaces should be coated with some suitable material to retard this action. Copper gaskets for flexible-staybolt caps should be removed, annealed and reversed in the cap at definite periods. Copper gaskets for Huron washout plugs can be replaced with a composition of 93 per cent lead, 2 per cent zinc and 5 per cent antimony, this metal must be die cast and applied to the plugs in the same manner as the copper gaskets.

Rubber—The conservation of all rubber is necessary, keep all air and acetylene hose off the floor by providing suitable overhead hooks adjacent to work. Use shorter lengths of air hose by extending air connections and providing outlets at both ends of each pit. Do not renew any hose if suitable repairs can be made.

Flues and Tubes—Extend the period between flue and tube renewals by providing adequate water treatment. Reduce the number of lengths carried in stock. Increase the number of safe endings above that specified in maintenance regulations. Apply new tubes and flues only to the long boilers and cut down the old ones for the short boilers.

Air Reservoirs—Remove the heads and use air-reservoir bodies for smokestacks and drainage culverts and large size case-hardening cylinders. Repair old air reservoirs when possible to do so.

Welding Electrodes—Provide suitable storage receptacles for all sizes of electrodes. Take only the amount required to each individual job. Use to the shortest possible length and return stub ends to the manufacturer if suitable arrangements can be made.

Tank Steel—Save and mark sheared ends from all tank-steel plates and use for small liners, washers and small structural plates.

Firebox Steel—Save and mark sheared ends from all firebox-steel plates and use for patches, liners, small structural plates and tender repairs.

Flange Steel—Save and mark sheared ends from all flange-steel plates and use for patches and miscellaneous material for locomotives and cars.

Staybolts—Remove staybolts from all old firebox sheets, clean, normalize and use for making machine bolts or for making iron and steel billets for forgings.

Rivets—Old rivets may be utilized in making billets for forgings.

Firebox Sheets—Remove staybolts and use the old plate for tender splash plates, pit covers, air-duct covers, car-door plates, washers and small liners.

Barrel Courses—Apply half courses when possible. Removed courses and part courses should be straightened and used for patches, smokebox liners, boiler support sheets, reinforcing liners for air-pump brackets, hub liners, wheel-center counterbalance covers and boiler-check reinforcing plates.

Tender Plates—Plates removed in making tender repairs should be trimmed to sizes suitable for cab repairs, running boards, ash-pan sheets, and tender lap plates.

Material substitution and conversion will be more nec-

essary in the future. The committee suggests that as the members make these substitutions and conversions they advise the secretary of the results obtained so that their experience may be passed on to all members.

The report was signed by E. H. Gilley (chairman), assistant boiler foreman, Grand Trunk Western, Battle Creek, Mich.; W. N. Moore (vice chairman), general boiler foreman, Pere Marquette, Grand Rapids, Mich.; R. M. Cincoski, boiler foreman, Northern Pacific, St. Paul, Minn.; E. Giles, boiler foreman, Temiskaming & Northern Ontario, North Bay, Ont., Canada; D. P. Smith, general boiler inspector, Chicago, Burlington & Quincy, Burlington, Iowa, and E. J. Brennan, general boiler foreman, Boston & Maine, West Medford, Mass.

Treating Boiler Feedwater Chemically

A general survey of the various phases of water-treatment programs—Methods of treatment briefly described for the layman

By F. B. Horstmann,

Technical Director, Railroad Department, Dearborn Chemical Company

F. B. Horstmann

There was a time when the various phases of a boiler-water treatment program were handled by separate departments on the railroads and with no close cooperation between the departments—the water treatment by the test or chemical department, the water itself by the water-supply department of the civil engineering department, the operating and maintenance of locomotives by the mechanical department. In later years the chemist, whether in the water-supply department or in the test department, cooperates with the mechanical and engineering departments and others that have to do with train movements and locomotive operation. In this cooperation, careful studies have been made, resulting in complete scientific water-treatment programs.

Complete Softening

There are two methods generally followed in the complete softening of water, one the so-called lime-soda ash method and one the Zeolite method. Both methods require an elaborate layout of equipment and considerable space and considerable handling by plant operators and are, therefore, high in original cost as well as in operating expense.

The lime-soda ash method is one in which a sufficient amount of lime is used to combine with the bicarbonate and carbonate hardness in the water and a sufficient amount of soda ash used to combine with the non-carbonate hardness in the water. To these reagents other chemicals are often added to handle specific problems in certain types of waters. The chemicals are generally accurately proportioned to the water being treated, the water allowed to settle for a reasonable length of time, after which the clear liquid is ready for use as the water supply, the residual sludge being properly disposed of.

This type of treatment, if carried to the extent that an extremely low-hardness water is supplied for boiler purposes, has many disadvantages, first among which is the relatively high causticity that is initially supplied and which develops in working boilers. The relatively large amount of alkali salts present in the concentrated softened water, in combination with small amounts of precipitating solids, give considerable trouble in the way of foaming and priming. Lime-soda softening plants controlled closely so as to supply water most desirable for locomotive boiler use will experience trouble with scaled or incrusted water supply lines and water columns. Therefore, it is generally necessary in connection with lime-soda softened water to use an after-treatment to control foaming and to prevent incrustation in pipe lines, etc. An organic-inorganic combination treatment will generally perform this double duty.

The Zeolite method of water softening is one in which the water percolates or passes through a type of filter consisting of a bed of either natural or synthetic sodium Zeolite. In so doing, all of the calcium and magnesium, or hardness salts, are retained in the filter and exchanged for sodium salts which pass out of the filter in the water. The reagent used in this type of softening plant is common salt. A considerable amount of salt is required for each regeneration of the Zeolite filter. The regeneration process is as follows:

After absorbing its maximum amount of calcium and magnesium, it must have applied to it a concentrated solution of common salt so as to free its calcium and magnesium and thus be again converted to sodium Zeolite. The remaining unused common salt must then be washed out by means of a back-washing process requiring a considerable amount of wash water.

With this type of softening system there is no reduction in the total dissolved solid content of the water after treatment; in fact, there is ofttimes an increase to the extent of about five per cent with the total dissolved solids in the softened water being chiefly sodium salts. Without after treatment this water will give considerable trouble in the way of foaming and priming as well as corrosion and pitting, with considerable corrosion and pitting even taking place in the treated-water distribution and storage system. Therefore, it is necessary in practically all instances to use an after treatment consisting of an organic-inorganic combination.

Internal Treatment

Internal treatment is often referred to as partial treatment as against softening or complete treatment. This is because reagents generally are used only in sufficient amount to eliminate from the raw water the non-carbonate hardness and to provide the necessary amount of reserve treatment to assure a satisfactory boiler water. The amount and type of reserve treatment required depends upon several features of the raw water, the chief of which is the amount of non-carbonate hardness, the non-incrustants, the type and amount of dissolved gases, the character of organic matter, and the type and amount of suspended matter.

This method with mechanical applications of chemical requires simple proportioning equipment designed to handle the requirements of the water. The equipment should be accurate in its performance, but it need not be elaborate, does not require great amounts of floor space, needs very little attention, both as to maintenance or operation, and, therefore, has in addition to a low initial cost a low operating and maintenance cost. Frequently, if conditions permit, this type of treatment can be applied direct to locomotive boilers or tenders and, therefore, without any treating-plant equipment whatever, eliminating treating-plant initial operating and maintenance costs completely. The amount of reagents or chemicals required are considerably less in quantity than required for complete treatment and, therefore, easier and less costly to handle.

The principal reason for classing this type of treatment as "internal treatment" is that reactions are controlled to such an extent they are only partially completed externally but are for the most part completed internally in the working boiler.

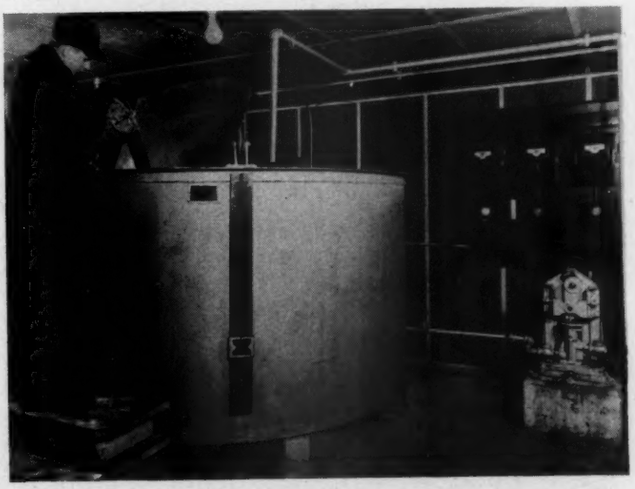
When internal treatment is referred to the general thought is of a type of treatment that reacts as a preventive of scale and incrustation and one that controls pitting and corrosion with no classing of anti-foam as an internal treatment. Anti-foam treatment should definitely be classed as an internal treatment as the reactions of this type of treatment, both chemical and physical, occur internally.

The above is a very sketchy outline of the various methods of water treatment generally in use today. Regardless of the method of treatment being followed, close observation has assisted in developing certain standards that are required in boiler water of working locomotives to assure continuous, efficient operation of locomotives at a minimum maintenance cost. In order to maintain these standards, it is the chemist's or water tester's duty to make the necessary continuous field tests on water as being supplied to locomotives and to order or make adjustments to keep it up to a satisfactory standard to assure the best type of locomotive boiler water. It is also the chemist's duty, or those working jointly with the chemist, to make observations on concentrated water from locomotive boilers to determine whether or not it is up to the standard required for a satisfactory concentrated locomotive boiler water.

In the constant removal of steam or distilled water from the working boiler the dissolved solids and suspended matter which are being constantly added in the feed water remain in the boiler. Certain of these solids remain in solution and others, due to chemical reactions brought about by internal reactions and heat, form sludge or suspended matter. Without treatment considerable of this sludge or suspended matter would form scale and incrustation and the concentrated soluble solids in conjunction with suspended sludge would increase the foaming tendencies of the water and the concentrated soluble solids in conjunction with dissolved gases and organic matter will stimulate corrosion and pitting.

The continuous increase of soluble solids, as well as precipitated sludge, requires provisions made for their proper removal. Blowing the locomotive is done for two specific reasons: one, to remove a certain proportion of the concentrated soluble solids, and, the other, to remove suspended matter or sludge or a combination of the two. To reduce or remove TDS (total dissolved solids) in a boiler in the most satisfactory and efficient manner, it is necessary that the blow-off facilities be properly arranged and, if possible, that blowing be done at such times as when no water is entering the boiler. To remove suspended solids from a locomotive boiler it is advisable that blow-off facilities or equipment be so arranged or placed on the locomotive that blowing will occur chiefly from the area in which the greatest amount of sludge or suspended matter accumulates. Since it has been found practical to eliminate water changes and to operate for extended periods of time between boiler washouts, it was found advisable to develop automatic blowing facilities or to follow systematic blowing schedules.

One of the widely used automatic blowing devices is the Signal Foam-Meter Electromatic blow-off system in which, through certain simple mechanical and electrical devices, enginemen are notified that the water, or the foam in the boiler, has arrived at a certain level. At a predetermined time blowing is automatically performed



An automatic proportioning plant for wayside feeding of internal treatment

and is continued until such time as the water drops below a predetermined level. Should water or foam at any time rise to an extremely high degree, a further notice is given to enginemen and they accordingly can proceed to relieve the locomotive boiler by the regular method of hand blowing or by following any other procedure that practice recommends to control this foaming.

A further improvement has been made in this device in the way of the Electromatic foam collapsing blow-off system. With this particular device a locomotive is equipped with a closed end trough located longitudinally directly under the dry-pipe intake with the bottom below and the top above the normal water line. This trough operates as a skimmer and collects surface froth or foam at the point in the vicinity of the dry pipe and where it is most objectionable. This froth or foam rolls over into the trough and is collapsed into the form of solid water. When it arrives at a certain height in the trough, features automatically occur that provide for the removal of the collapsed foam.

Locomotives thus equipped are also provided with signal devices that notify the crew of the high-water or foam condition so that they are in the position to offer any additional relief in the form of hand blowing, if necessary. With either of these devices and with properly treated water it is generally unnecessary to set a specific boiler-water concentration for any particular locomotive or locomotive district.

Hand Blowing

For the hand-blowing method of concentration control it is necessary to determine the most satisfactory locomotive boiler concentration that can be carried on the particular class of locomotive, or locomotive district. After this a blowing schedule can be arranged that will specify a certain number of seconds to be blown over a specified number of miles or for a specified time of operation of the locomotive. As an example, on certain railroads passenger and freight locomotives are given 3-sec. intermittent blows from both the right- and left-hand blow-off cocks every 25 miles of operation. Some railroads have blowing posts located along the right-of-way and crews are given instructions of the amount to blow at blowing posts. Switch locomotive crews are given instructions to blow a specified number of times or seconds every half hour of locomotive operation.

Terminal Blowing

Railroads that are giving careful consideration to concentration control blow a scheduled amount when locomotives arrive at terminals and also blow a scheduled amount when locomotives are ready for despatchment. The amount blown on arrival at the terminal depends upon the boiler-water concentration on arrival and the concentration to which the boiler should be held at the terminal. Locomotives should be despatched at scheduled concentrations and, if the boiler water exceeds the specified concentration, boilers should be blown accordingly. Locomotives held under steam in enginehouses or in standby service should also have their boilers blown according to a schedule set to the time under steam so that a satisfactory working concentration will be had on despatch.

Satisfactory results from a complete water-treatment program can be obtained only with adequate control. Proper control in connection with the specific problem of blowing requirements is by the determination and regulation of boiler-water concentrations. This control should cover two important phases of boiler-water handling; namely, terminal and road.

Terminal Control

Samples of water should be properly collected from boilers upon their arrival at the terminal and at any other necessary time while at the terminal. These samples should be tested for total dissolved solids as well as any other tests that are generally considered necessary at the individual terminal at the time of sampling.

Road Control

A check on road or working performance of boilers should be made whenever thought necessary to determine the concentration pick-up and also to determine the amount of blowing that is being done or should be done. Samples of boiler water should be collected from working locomotives and tested for total dissolved solids. On these samples other tests can be conducted to determine if the boiler water is such as to assure satisfactory boilers and good locomotive performance.

Total dissolved solids is of particular interest in both terminal and road control. There are several methods for making their determination. Determinations of total dissolved solids by any of the approved field methods is remarkably exact when the amount of soluble solids present in the average concentrated boiler water is considered. Accordingly, great care and cleanliness is required in making the field determinations, equally as much as in the chemical laboratory where the chemist has access to very delicate apparatus and to ideal working conditions.

Considerable of the precipitated solids in a working boiler circulate with the water; therefore, any blowing performed removes a certain proportion of these insoluble solids along with the soluble matter. Any precipitated matter heavier than that which circulates, accumulates or gathers in quieter spots in the working boiler. At these spots or in these areas proper facilities should be provided for the periodic manual removal of these heavier precipitates or sludge. Circulating sludge and concentrated soluble solids can readily be removed by many of the

A modern chemical laboratory for making complete boiler water analyses

automatic blowing devices, such as the automatic constant blow-off system, Signal Foam Meter Electromatic blow-off system, or Electromatic foam-collapsing blow-off system. For the removal of the heavier noncirculating sludge systematic hand blowing should be practiced.

Meeting the qualification above noted, and generally

Field water testing laboratory at a railroad terminal

accepted, flues and sheets should be free from all indications of scale and incrustation and corrosion and pitting, and flues should be allowed extensions to the maximum. Staybolt breakage should be entirely eliminated. There should be no scale accumulation on bolts or fillets or scale formed where bolts and sheets join. Therefore, no overheating should be experienced. The boiler water should be sufficiently solid to give the necessary contact with bolts and sheets to give maximum heat transfer and, accordingly, prevent overheating from the lack of proper circulation.

It has been argued that blowing of boilers results in a heat loss. This is true, but should the heat loss from improper circulation, insulating scale, etc., be checked against that required to keep a boiler always in best condition, it will be found that systematic blowing and proper water treatment are in the end considerably less expensive.

Under a complete scientific water-treatment program, shoppings are extended to several hundred thousand miles, locomotives work up to the legal limit between washouts, water changes are a thing of the past, and, accordingly, locomotives give practically a straight-line performance with the only time out being required for the between-trip layover and for the regular authorized inspections.

Thus far concentration control has been given chief consideration with but slight mention made of decrease in blow-off requirements. Blow-off, to a limited degree, can be controlled by the use of the various devices and methods heretofore outlined, but the most satisfactory procedure to follow to reduce the blow-off requirement is by the use of special types of water treatment that react in such a manner that steam bubble formation is brought under control.

Instead of endeavoring, as in the past, to overcome the ill effects of foaming by foam control, the scientific procedure to follow is to treat the locomotive boiler water in such a manner that steam bubbles developed in the body or on the surface of the boiler water have a surrounding film of a type that is practically no thickness and have a minimum of tenacity and, accordingly, break immediately on arrival at the liquid surface and without projecting any appreciable mist or droplets into the steam space. Thickness and tenacity of film are related and the procedure followed for controlling one will generally control the other.

By properly controlling the steam bubble film, boiler-water concentrations can be appreciably increased and

Determination of total dissolved solids by the hydrometer

blowing reduced in proportion to the increase in concentration. Better and more economical locomotive performance is possible with this type of foam control, the boiler water can carry the necessary water treatment that will assure complete freedom from scale and incrustation in the boiler as well as in boiler accessories and which will also completely neutralize all-corrosion possibilities.

Satisfactory complete treatment that will prevent all the troubles that have been heretofore experienced in locomotive boiler practice is possible. Such treatment is in practice on several railroads throughout the United States. Particularly during the present emergency when all railroad equipment should be performing at full time and most efficiently, it is important that all methods that bring about improved service should be adopted.

A. J. Krueger,
Acting President

G. R. Andersen,
First Vice-President

D. J. Sheehan,
Second Vice-President

Constructive Reports on Car Subjects Prepared

I. M. Peters,
Third Vice-President

F. L. Kartheiser,
Secretary-Treasurer

P. J. Hogan,
Fourth Vice-President

Car Department Officers' Association continues to function during the year but on reduced scale — War-time training of supervision and recommendations for revisions of interchange and loading rules among subjects discussed in five committee reports

THE national group of railway car supervisors, known as the Car Department Officers' Association, has held no general meeting since its annual convention at Chicago in September, 1941, but the general committee and various standing committees have met as required to keep the association functioning and make plans for the future. During the year, President F. E. Cheshire left his position as assistant superintendent car department, Missouri Pacific, to head up car matters for the Military Railway Service with the commission of Major, U. S. A. In the absence of Major Cheshire, A. J. Krueger, superintendent car department, Nickel Plate, who is a past president of the association, has assumed the duties of president.

Other officers of the association, promoted during the last year, include Vice-president G. R. Andersen, who has been made assistant superintendent of the car department, Chicago & North Western, and Secretary-treasurer F. L. Kartheiser, who has been made assistant to the executive vice-president, Chicago, Burlington & Quincy. All officers of the association will hold over until the next annual meeting.

In addition to President Krueger, First Vice-President Andersen, and Secretary-Treasurer Kartheiser, they are: second vice-president, D. J. Sheehan, superintendent motive power, C. & E. I., Danville, Ill.; third vice-president, I. M. Peters, superintendent and secretary, Crystal Car Line, Chicago; fourth vice-president, P. J. Hogan, supervisor car inspection and maintenance, N. Y., N. H. & H., New Haven, Conn.

Changes in Loading Rules Recommended

The reasons given include simplifications, increased security, and increases in scope of some of the rules

E. N. Myers, Chairman

Because of the present emergency, the committee did not hold a meeting this year, but the chairman, with F. Cebulla, general car foreman freight equipment, Great Northern, the only other member located in the Twin Cities, went over these suggestions, presented by mail by the members. The committee submits the following proposed additions and changes in A. A. R. loading rules with the recommendation that they be referred to the Association of American Railroads for consideration by the Loading Rules Committee.

General Rule 4

Sec. B, Par. 2, reads as follows: The percentages of stenciled load-weight limits, as shown in the table, must not be exceeded for loads located between truck centers measured lengthwise of car, except when the car owner designates otherwise by note in the Official Railway Equipment Register, or by stenciling on the car:

Flat and Drop-End Gondola Cars	Other than fish-belly type sills, per cent	Fish-belly type per cent
18 ft. long or less	66.6	75
Fixed-end gondola cars		
10 ft. long or less	...	40
Over 10 ft. to 20 ft.	...	50
Over 20 ft. to 24 ft.	...	60
Over 24 ft. to truck centers	...	75
Extending beyond truck centers	...	100

The committee recommends that the last paragraph, "Fixed end gondola cars, etc.," be eliminated and this class of cars be included in "Flat and drop-end gondola cars."

Reason.—The construction of the underframe on fixed-end gondola cars is similar to flat and drop-end gondola cars.

Fig. 3 or Rule 21

The committee recommends that the following be inserted under Fig. 3 or in General Rule 21, or both: Cars must be jacked apart so as to fully compress draft gear by placing a jack on each side of coupler. Insert metal or composite blocks (except cast iron) to fully fill space back of coupler horn.

Reason.—Shippers comply with present rule requirements by filling space without jacking cars apart, leaving considerable space not filled in when draft gear and coupler slack is taken up in handling.

Fig. 5-A

This sketch of the method for narrowing loads of poles and lumber shows the wiring for the binder stakes, but no top wiring is shown for the other stakes. It is felt that this should be shown on the figure.

Fig. 6

The committee recommends that the A. A. R. Committee on Loading Rules give consideration to the advisability of removing Item E from Fig. 6. If the committee decides this should not be done, it is then recommended that the dimensions of Item E be 4 in. by 6 in., making the base 2 in. wider than the height.

Reason.—Experience has developed that these 4-in. by 4-in. pieces are acting as rollers which are an aid to disarrangement of loads. The loads shift off the blocks and it is impossible to get them back without reloading the material.

Fig. 40

The committee recommends that assorted widths or shapes 12 ft. or longer, loaded on flat cars, if lapped in one pile not extending over the side of the car floor, Item B be applied in all stake pockets and Items C and D not to be more than 3 ft. away from the end of the load. Plates less than 12 ft. long, side protection of 2-in. planks be securely nailed to Item B extending to the height of the load, Items C and D not to be more than 3 ft. away from the end of the load.

Reason.—The present figure shows the method of loading uniform widths, but is silent on assorted widths, lengths or shapes.

Fig. 47

Item C—Under number of pieces, it is shown that two are required for each pair of Item B. This, we feel, should read one.

Reason.—The figure in sketch No. 1 shows one strap Item C and 1 strap Item D for each pair of rods.

Fig. 56

The committee recommends that Item M be of 6-in. by 8-in. hardwood to be held in place directly under Item E with two ⅜-in. by 6-in. by 12-in. plates, one on each side of Items M and E, fastened with two ⅝-in. by 10-in. bolts through Item M and plates, and one ⅝-in. by 10-in. bolt through Item E and plates. Bottom of Item M fastened to Item B with two 3-in. by 3-in. by 6-in. by ½-in. angles, one on each side of Item M with two ⅝-in. by 10-in. bolts through Item M and angles and four ⅝-in. by 5-in. lag screws, two on each side in Item B and angles, one ½-in. by 7-in. split bolt near bottom of Item M, Item M not required on loads less than 30 in. high except when height of load exceeds width.

Reason.—Present size 4-in. by 6-in., spiked to Items E and B, do not stay in place, causing same to break, resulting in cars being shopped. If 6-in. by 8-in. material is used and fastened as outlined, same will stay in place and serve the purpose intended for Figs. 48, 49, 50, 52, 53, 54, 57, 58, 59, 60, 61; Items H, O, P, F, H, J, M, O, M, K and O, respectively, these items being the same as shown for Fig. 56.

Fig. 56-A

The committee recommends flexible material loaded as double loads be tied down as per Fig. 56, page 141. (It now permits loading of flexible material as double loads without being tied down at bearing pieces, merely having two 2-in. by 6-in. by 10-in. cleats nailed on top of bearing piece on each side.)

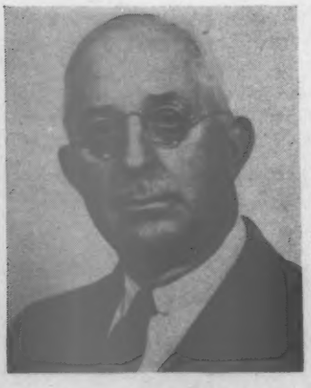
Reason.—Necessary to eliminate excessive shifting.

A great deal of trouble is being experienced with heavy sheet steel loaded in gondola cars where the total space between load and sides of cars is more than 18 in. On the banded loads the bands are breaking and side blocking is becoming displaced and loads are shifting to one side. On this heavy sheet, the bands are not of much use, as in most cases some or all of them are broken and the present requirements for side blocking are not sufficient. It is recommended that consideration be given to the elimination of bands for this type of load and provide for more substantial side blocking.

The report was submitted by E. N. Myers (chairman), chief interchange inspector, Twin City Joint Car Inspection Association, St. Paul, Minn.; H. T. DeVore, chief interchange inspector, Youngstown Car Inspection Association, Youngstown, Ohio; H. H. Golden, supervisor, A. A. R. interchange and accounting, Louisville & Nashville, Louisville, Ky.; L. T. Donovan, inspector of loading, A. A. R., Pittsburgh, Pa.; T. E. Hart, supervisor of loading and interchange, New York, Chicago & St. Louis, Cleveland, Ohio; W. P. Elliott, general foreman, Terminal Railroad Association of St. Louis, East St. Louis, Ill.; S. C. Montgomery, general foreman car department, Illinois Central, Memphis, Tenn.; W. A. Emerson, general master car builder, Elgin, Joliet & Eastern, Joliet, Ill.; F. Cebulla, general car foreman, freight equipment, Great Northern, St. Paul, Minn.; and N. Arnold, general car inspector, Missouri Pacific, Kansas City, Mo.

The Selection and Training of Supervision

Qualifications to look for in men selected for promotion—Opportunities for preparation which can be offered to foremen candidates



J. E. Keegan,
Chairman

It is of the utmost importance at this time, with the great task confronting the railroads, that the selection and training of car-department supervision be most carefully done. In selecting men for this important work there are many things to be taken into consideration. The most important of these are appearance, physical condition and personality, general knowledge of car construction and maintenance, willingness and ability to transmit this knowledge to others, leadership, responsibility, the desire to cooperate, ambition, and loyalty to his employers.

During the present emergency, the labor situation will become more and more acute. It will be necessary to use men on mechanical work such as car repairing, inspecting, on machine work, welding, etc., whose knowledge and experience is limited. It will be the duty of the supervisor to teach these men and to know that the work done by them is properly done. With the immense amount of traffic being handled by the railroads, the great necessity that rolling stock be in proper condition so that traffic will not be delayed by car failures and that loaded cars move without delay due to defective condition, cannot be too strongly stressed.

It is preferable to select younger men who have served an apprenticeship. They have obtained a general knowledge of car construction and maintenance and have demonstrated by their ability to complete an apprentice course that they have the ambition to continue as carmen. However, many very competent supervisors have been selected who have not had the advantage of apprentice training. Very often a repairman, inspector, etc., will demonstrate by his actions that he is qualified for consideration as a supervisor.

A prospective supervisor should at first be given a trial by being assigned as a gang leader or gang foreman to fill temporary vacancies among the regular supervision. This will demonstrate his ability as a leader. During this time he should be given an opportunity to

read blueprints, reports, correspondence, become thoroughly familiar with A. A. R. rules of interchange, loading rules, and mechanical instructions issued by his company. He should also become familiar with the proper procedure in obtaining material. Safety First must be impressed on him. He should be given special assignments in investigations and developing tools and devices which are so necessary for the efficient operation of car shops. He should be sent out on the road to obtain information and check operations. Reports prepared by him will give an insight into his ability to carry out instructions. It is advisable to start the preliminary training if possible at a larger shop where he will be under the direction of experienced foremen. When the opportunity permits he should be assigned as a permanent gang leader or gang foreman.

The proposed supervisor should then be sent to a smaller shop as foreman. This will develop his sense of responsibility and demonstrate his ability to cope with situations that will test his ingenuity and resourcefulness. Here the necessity of cooperation with other departments will be impressed on him. Very often the activities of a foreman at some small point have been brought forcibly to the attention of his superiors, which has reacted greatly to his credit.

If the supervisor has shown the proper ability, he should be transferred to a larger point as assistant foreman so that he will become experienced in handling a larger volume and variety of work such as that at freight yards, passenger yards, heavy interchange points, etc. He will thus obtain a general knowledge of car department work.

It is desirable to hold meetings between car department heads and foremen, assistants and other supervision to exchange ideas and to know that various car department matters are thoroughly understood by all concerned and are being observed. Foremen should be encouraged to attend meetings of local associations of car men. Such meetings are educational and it is greatly to the advantage of car-department supervisors to know and to cooperate with the supervision of other railroads in their locality. Much can thus be done in expediting the movement of the many commodities of war which is of such tremendous importance today.

The report was presented by J. E. Keegan (chairman), chief car inspector, Pennsylvania, Chicago.

Roller-Bearing Experience on Passenger Cars

What the bearings accomplish—Methods of inspection and maintenance—Kind of lubricants required—Causes of bearing failures

Ebert Photo

C. P. Nelson

Admittedly the logical prospect for anti-friction bearing applications, the railway journal bearing has been one of the last to be successfully fitted. This condition has been due primarily to the tremendous loads and constant pounding to which the bearings are subjected even in ordinary service and in part to the reluctance of railway officials to experiment where failure of the part being fitted might jeopardize human life. Predominant among advantages resulting from the installation of roller journal bearings are the large reduction in initial starting effort, an average reduction of 10 per cent in running effort under all conditions and a marked drop in maintenance costs. Thus, it is not only possible to haul heavier trains with existing locomotives but because accelerating periods are decreased, maximum speeds can be lowered without affecting existing schedules. Shorter acceleration periods and lower maximum speeds make for more profitable operation because of the decreased fuel or power consumption per ton mile.

Twenty-five years of discussion on the subject of roller journal bearings by bearing manufacturers have definitely brought to the foreground certain requirements which must be met by the designer, namely: (1) ample capacity to carry all loads encountered without heating; (2) positive lubrication at all speeds and temperatures; (3) lateral adjustment possible when made necessary by truck wear or distortion; (4) simple installation and maintenance; (5) interchangeability with A. A. R. equipment.

Back in 1934 was launched an epoch-making experiment—the introduction of the first streamline train. Developed in an effort to check the alarming decline in rail travel caused by the bus and private automobile, the lightweight, high-speed train represented a combination of the structural engineer's ingenuity and the streamline designer's skill. Today there are more than sixty such trains operating in every section of the country. Over fifteen million passengers have been handled, yielding well over four billion passenger miles with speeds averaging from 90 to 110 miles per hour—almost breathtaking proof of the successful efforts of the railways to promote passenger progress.

The sustained high speeds and high daily mileages of modern service make anti-friction journal bearings a necessity. Bearing reliability is now by far the most important requirement. It dictates every phase of bearing design and manufacture and receives first consideration by motive power and car departments in bearing selection. The reliability of the various types of anti-friction bearings have been thoroughly proved in service under high speeds and for satisfactorily high total mileages. Their simplicity and massive proportions insure satisfactory performance under modern operating conditions.

New materials in car construction, air conditioning,

and the features of both exterior and interior design and appointments for passenger appeal have influenced car departments to make investments in costly new equipment which demands the greatest utilization. Maintenance which formerly may not have caused serious interruptions of service or even burdensome expense is now intolerable. The new and attractive but costly equipment must be in and out of terminals on the closest schedules that traffic will support. This means that mechanical devices used thereon must operate for long periods of high mileage with very little attention.

The satisfactory operation of journal bearings is absolutely necessary to the success of the new equipment. Only anti-friction bearings can withstand the severity of the service. Roller bearings have proved their reliability. As modern as the most modern of equipment, roller bearings embody every advance in metallurgy and every improvement in design to provide the longest possible trouble-free service life. They are designed in various shapes and sizes—spiral, spherical and tapered rollers with races and box constructions meeting their specific requirements, each design made to satisfy the requirement that a special lubricant be not necessary, that oil consumption be low and the need for inspection infrequent.

Thorough knowledge of service conditions, long experience with many installations and continuous engineering development are reflected in the design and construction of all roller bearing parts including races and housings, every feature having been studied and subjected to a thorough test before adoption.

Terminal Inspection and Maintenance

It is generally conceded that all roller journal bearings, regardless of type or manufacture, receive somewhat the same attention insofar as terminal inspections are concerned. Immediately upon arrival of trains at the established terminals the roller bearing boxes are felt with the bare hand to determine the approximate temperature. Running temperatures varying from 15 deg. to 50 deg. F. above that of the atmosphere is considered normal. Temperatures in excess of the latter warrants further inspection, to the extent in some instances of removing wheels and the complete dismantling of boxes in the endeavor to locate the origin or cause for the excessive heating.

Pipe plugs, bolts and nuts are checked each trip to determine if tight, the boxes carefully examined for any service condition that may have caused damage to the box or parts. Oil levels are checked daily with gages provided for this purpose. If oil level is close to the minimum marking on the gage a sufficient amount of oil is added to bring the oil up to the maximum marking. If the oil appears to be discolored or indicates presence of dirt or moisture, the lubricant is drained and the box is flushed out with hot oil or kerosene, then being refilled to capacity with clean oil. The presence of any metallic substance in the oil prompts a removal of the wheels and dismantling of boxes. Many railroads have a practice in effect whereby boxes are checked periodically for water content in the oil—this being done by opening the drain cock slightly and allowing condensed water to escape. It was also found that certain railroads arbitrarily remove box covers in the train yard semi-annually, preferably in the spring and fall, for a visual inspection of roller bearings, cleansing of boxes and refilling with new oil.

Oil should be renewed at wheel turnings, wheel renewal or when wheels are stripped for axle inspection. In some sections of the country where extremely cold temperatures are encountered for long periods of time it is often necessary to thin the regular oil to assure fluidity. This should be done by adding a quantity of lighter oil. Kerosene should never be used as a thinning agent. A partial inspection of the bearing, so far as is possible, should be made at each wheel turning. When wheels are renewed, the bearings and housings are removed from the axle and at this time they should be thoroughly cleaned and inspected.

Kerosene or a commercial solvent may be used to clean the bearings, housings and smaller miscellaneous parts. Some roads, which are operating a large number of roller bearings, find it economical to clean both bearings and boxes in a bath of hot caustic solution. If this method is used, the bearing and box should be rinsed in hot water and steam jet to remove all traces of the caustic. The parts should then be thoroughly dried and covered with a light coat of oil to prevent corrosion while waiting for inspection and re-application. Under no circumstances should waste ever be used to clean bearings or contained parts. The use of rags or a soft brush is advocated. For the lubrication of roller bearings, our experience has shown that a well-bodied mineral oil should be used to the following specifications: Flash Point, not below 500 deg. F.; gravity at 60 deg. F. not below 22 deg. F. Baume; viscosity at 210 deg. F., 125-150 sec.; cold test, not above 30 deg. F.

Loss of oil from boxes can be attributed in a majority of cases to irregular tread wear of wheels, worn boxes, pedestals and liners as well as loose retainer bolts.

Lessons From Roller-Bearing Failures

To speak of the failures which have occurred is always distasteful, often unpleasant and sometimes downright embarrassing. Yet only through study of such deficiencies can real progress be made in the ultimate improvement of roller bearings and their correct maintenance. With no intent of avoiding responsibility, but simply to keep the record straight and to furnish a legitimate point of departure for an analysis of bearing failures, it should be stated at the outset that a reasonable percentage of the defects in service must be attributed solely to causes beyond the control of the bearing manufacturer—in other words, purely and simply the fault of the user. With this in mind, the bearing manufacturers have done their utmost to better acquaint all users with the "do's and don'ts" of bearing care and maintenance—particularly in the current period of near-shortages and vital need for high production.

Some of the more common causes of failure are dirt and abrasives, faulty lubrication, mis-alignment, improper mounting and overload. Of these the greatest is dirt —public enemy number one in the life of a roller bearing. Any foreign matter other than the proper lubricant is to be construed as "dirt" incidentally, and it may gain entrance during assembly, repairs, from the atmosphere, or even as adulterants in the lubricant itself. A not-too-untypical analysis, for example, of the materials which get into a bearing while in service shows particles of metal, grit, sand, sawdust and graphite which act as an effective grinding compound. This has led many railroads to adopt a magnetized filling plug in the endeavor to draw out minute metallic particles from the oil.

A roller journal bearing, correctly applied and properly lubricated, offers trouble-free service. It sometimes happens that wheels are changed or turned and bearing installations removed and reapplied so that the assembly is made in accordance with the specific maintenance instructions. There have been cases where bearing applications have been placed in service without lubricant in the boxes or housings. No bearing can be

expected to operate for any length of time under such conditions. It will heat up and be completely destroyed unless the trouble is detected promptly.

In order to enable engine or train crews to detect these and other abnormal operating conditions before serious damage has been done, heat indicators have been developed and used on the boxes. This device has been aptly termed a "stench bomb" and consists of a cylindrical container holding a liquid (mercaptin) which when heated gives off an extremely pungent and penetrating odor. The container is sealed with a bismuth solder plug. If for any reason the temperature inside the bearing boxes exceeds 220 deg. F. the plug melts instantly, releasing the stench agent to the atmosphere. When the resultant odor is detected, the train is stopped at once and the overheated bearing located. With this procedure no material damage should ensue. An examination is then made to determine the cause of the overheating and proper precautions are then taken before operating the equipment further. When equipment reaches the shop or terminal all parts of the bearing application should be thoroughly examined and repairs made. Tests have proved that the odor from the heat indicator can be detected in air-conditioned equipment operating at high speeds and will remain in the cars from 10 to 15 minutes. These indicators however are gradually being supplemented by the electrically operated journal-box alarm, which transmits a signal to the car interior if any box develops an abnormal temperature. These methods are proving successful in preventing failures, the origin of the overheating being quickly located and corrected.

We find it unimportant to discuss methods pertaining to the mounting and assembling of roller bearings as well as the checking of lateral for the reason that these practices vary with the different types of bearings in use, the manufacturer ably covering this phase of the operation and maintenance with printed and illustrated instructions for the guidance of the carriers.

The report was submitted by C. P. Nelson (chairman), assistant superintendent car shops, Chicago & North Western, Chicago.

Keep Down Detentions of Cars in Bad Order

More use of bad-order-when-empty card suggested—Extend repairs made when cars are empty—Inadequate facilities no excuse for failure

It is highly essential now, more than ever before, that carmen exercise every effort to reduce the detention of cars in bad order to the lowest possible point. Your committee feels that no car should be loaded, which will not, except in the unusual case, carry its load to destination and we are fully in accord with the work being done by special committees at many terminals under the direction of the A. A. R. Mechanical Division. Campaigning in this manner, i. e., to get all required repairs made when cars are empty, will naturally result in the elimination of subsequent bad-ordering of cars shortly after having been released from a repair track. If and when this is done it will materially reduce the detention of cars on account of being in bad order.

Knowing that we have not yet reached the desired goal, we strongly recommend that every effort be put forth by car-department supervisors to differentiate between defects which require the shopping of loaded cars and those which may be allowed to run until the car is made empty. Relying on the experienced judgment of competent carmen, we feel that they will rise to the opportunity of utilizing their experience for the continuous, dependable movement of traffic during times such as these.

As a further stimulant to emphasize the importance of letting loaded cars move to destination without interruption, the suggestion is advanced that more general use should be made of the bad-order-when-empty card, it being felt that this would serve two purposes: First, that the defects would be repaired before cars are reloaded; second, that it would continually keep the car inspector mindful of the fact that loaded cars must not be shopped unless absolutely necessary.

Further study in connection with this subject develops that many cars are being unnecessarily detained, both in sending to repair tracks after being shopped in transportation yards and in extension of repairs after the cars have been set. Where this condition prevails, invariably no practice is in effect whereby the repair track supervisors have any knowledge of how many bad-order cars are being held out for placement, when they were bad ordered or when they might be set, depending entirely on the transportation department of the service to get them set on the repair tracks. Some cases are noted where this information is available at the end of the shift or day. However, in many cases, several hours of detention accumulate before the repair-track supervisor knows that the cars are bad order.

We recommend that this association go on record as favoring the use of a standard form to cover bad-order cars, this form to be furnished as information to all concerned and show the car initial, car number, date and time bad ordered, date and time placed in shop, date and time ok'd, and detention hours if so desired.

Summing up our observations we believe that adherence to the following suggestions will materially help obtain desired results:

(1) Education of inspectors and others as to the necessity for minimum shopping of loaded cars.

(2) Extension of all necessary repairs to empty cars placed on repair tracks for so-called light and running repairs, including periodical attention to journal boxes and air brakes, gaging of parts condemned by certain gages, etc.

(3) Adequate record or report to cover bad order cars to insure prompt switching to repair tracks, prompt repairs and returning to service.

(4) Rigid inspection of open-top cars at originating points to insure better compliance with the loading rules.

(5) Extension of assigned seven-day forces to meet present requirements.

(6) General and heavy repair programs commensurate with service requirements, with removal of only sufficient cars from service required to keep the program moving.

(7) Building of cars designed to meet the specification of the A. A. R.

Obviously the question of existing facilities and forces

was discussed in connection with submission of this report. Your committee feels that, while in some cases improvement is desirable, due to present conditions and those of the immediate future, it is incumbent upon us as railroad men and as carmen to do the job well with what is available, utilizing each facility to its fullest extent. In connection with the whole war effort, cars must and will be repaired promptly and dependably under much more trying conditions than have heretofore existed and we must go slow in excusing questionable performance and unnecessary detention of cars in bad order for lack of more desirable facilities. This committee sincerely hopes that no one, at this time will use the lack of facilities as an excuse to cover up excessive detention to cars in bad order but that ways and means will be found to decrease the time heretofore consumed.

The report was submitted by H. E. Wagner (chairman), division general car foreman, Missouri Pacific, Dupo, Ill.

Interchange and Billing for Car Repairs

Changes recommended in rules to simplify interchange inspection and reduce paper work required of car inspectors

The committee recommends the following revisions in the existing interchange rules which are submitted for consideration by the Arbitration Committee of the A. A. R. Mechanical Division. These proposed changes will become effective only if and when they have been officially approved by the Mechanical Division.

Freight Car Rules

Rule 4

Relocate Par. (a) as Par. (b) which is eliminated.

Substitute the following for Par. (a): All reference in these rules to "Delivering Company responsible" shall apply to non-per-diem cars only, excepting such per-diem cars as are damaged to the extent of the various provisions of Rule 44 and all cars damaged to any extent when involved in an accident sufficiently extensive to be properly reportable under the provisions of the regulations of the Interstate Commerce Commission as to reporting accidents. All other damage to per-diem cars shall be "Owners responsibility." Defect cards for damage to per-diem cars, the responsibility of the delivering line, must be affixed to cars prior to their movement from scene of accident or prior to their movement from repair point should it be necessary to send the cars to a repair point for temporary or partial repairs. All defect cards issued for per-diem cars must bear the notation "Home for Repairs."

Reason.—It is a well-known fact that there is included in the per-diem dollar an amount to cover all maintenance due to ordinary wear and tear as well as that due to unfair usage. With such factor included, the user or foreign handling line, through the present method of assessing responsibility for delivering line damage, pays twice for maintenance, first through the payment of the established per-diem rate and secondly through the bill based on his defect card. It is to remove this unfair distribution of the maintenance expense that this suggestion is made. It is further suggested that there will be much needed relief for interchange car inspectors, particularly at this time of needed speeding up of transportation, by eliminating the necessity of every interchange car inspector closely inspecting all cars, regardless of ownership, for what is now termed delivering line damage, and the writing of defect cards or the copying thereof, that his company's interests may be protected. At this time, when we are more concerned with safe train movement than with division of responsibility, it is felt that all efforts of the car inspector should be directed toward safe train movement. This reclassification of defects will give car inspectors the necessary time for more thorough inspection.

Rule 9

Change the item now worded "A. A. R. couplers, or parts thereof, R. & R." to read "A. A. R. couplers, R. & R.," eliminating the words "or parts thereof."

Eliminate from opposite this wording, "Top or bottom operated." Eliminate from opposite this wording the "Note," relocating it as hereinafter recommended.

Establish a new item worded "Coupler knuckle, R. & R." Establish requirements for coupler knuckles as, New or secondhand and type. Depth of knuckle face (9 in. or 11 in.).

Relocate Note now appearing opposite wording "A. A. R. couplers, or parts thereof, R. & R.," locating it opposite this recommended new item, "Coupler knuckle, R. & R." Establish a new item worded "Other coupler parts." Establish requirement for other coupler parts as, New or secondhand and type.

Reason.—To eliminate unnecessary wording on repair cards, the present requirements necessitating the writing of much detail for knuckles and other coupler parts that is of no use whatsoever.

Rule 10

Revise the first paragraph to read: In noting the cause of removal of wheels and axles, the terms shown in Rules 68 to 86, inclusive, or the A. A. R. recommended practice symbols for marking defective wheels, shown on pages 159, 160 and 161, must be used. Both may be shown, however; the omission of either from the billing records will not justify exceptions to charges.

Reason.—To permit showing symbols alone, if desired, reducing the volume of writing in the compilation of billing records.

Rule 17

Revise the second paragraph of Sec. (e) Note 5 to read: This also applies to beams having third-point suspension feature if car is equipped, at two or more beam locations, for functioning of this type of suspension.

Reason.—Most lines are purchasing all brake beams with third-point suspension jaw cast integral with strut, and, in the application of such beams to foreign cars, transfer the four-point sliding chairs from the removed beam to the applied beam. Under the present rule, where two such beams are applied, the standard of the car is changed without the owner's intention. Beams subsequently applied are then equipped with third-point slid-

ing chair and a charge rendered against the car owner. The standard of the car established by the suspension members should be the governing feature and not the attachments to the brake beam.

Reword the question in Interpretation B-6 to read "If defective geared hand brake meeting requirements of A. A. R. specifications is removed from a foreign car," etc.

Reason.—To eliminate the necessity of repairing lines holding for disposition old style obsolete brakes, disposition not being furnished, the ultimate result, after incurring expense of correspondence, being the placing of such brake parts in the scrap. It is felt that only those brakes that meet A. A. R. specifications should be held for owner's disposition.

Eliminate the second paragraph of the answer to the question in Interpretation C-2. Eliminate in its entirety Interpretation M-10.

Reason.—Few owners find it economical to take advantage of these provisions permitting the return of material. Their inclusion in the rules only occasions unnecessary correspondence, expense of handling line for storage and handling, and delays the return of scrap to a usable source.

Rule 60

Reword Par. (f) with reference to stenciling location and provide that stenciling shall be located on car body near the body bolster at diagonal corners adjacent to the journal box repacking stencil.

Reason.—To place the stenciling in clear view without going underneath the car to clean off the brake reservoir, and to make the checking of the air brake date and the journal box repacking date at one glance and without the necessity of passing to the opposite side of the car should the inspector be on the side opposite to the reservoir.

Eliminate Sec. (j) in its entirety and revise Sec. (k) to read as follows: Charge for cleaning air brakes within the 14 months' time limit is now permissible on account of renewal of defective air reservoir on detachable type equipment, or cylinder gasket on detachable or combined type equipment.

Reason.—The rule as now written leaving the decision about cleaning brakes, or renewing certain defective parts causing the brakes to be inoperative to the discretion of the repairing line is causing considerable annoyance since, for example, the repairing line may do a perfect job in cleaning brakes and yet be required to cancel its charges because a cylinder gasket tested and meeting all test requirements happens to fail within the 60-day limit. Then, in other instances, the practice of some repairing lines in renewing certain parts now permitted by the rules, instead of cleaning the brakes, is being, by the car owner, contrasted, with the practice of other repairing lines which, instead of renewing certain permissible parts, clean the brakes. This comparison is used in an effort to force the latter line to reduce its charges to what the charge would have been had the permissible items been renewed instead of the brakes being cleaned.

The rule should be so worded as to make for uniform procedure and reduce controversies about charges to a minimum.

Add an additional note to Sec. (m) as follows: Cleaning periods herein established are not applicable to cars the brake system of which is under observation and study, identified as "Experimental-Test," or "AB Brake —Experimental." Such brake equipment must be handled in accordance with circular DV-797 and reprinted in circular DV-829.

Reason.—To avoid delays to such cars by reason for car inspector's sending them to the repair tracks on account brakes out of date. While all member lines have the instructions contained in the circulars referred to and those in a supervisory capacity are aware of the provisions thereof, it is doubtful that all car inspectors are conversant with the instructions. It is felt that reference thereto in the interchange rules will result in complete information pertaining to the subject being passed on to the car inspectors.

Revise the air-brake markings cut, pages 124 and 125, in accordance with recommended change to Sec. (f), Rule 60.

Rule 63

Reword the last sentence of note following Sec. (c) to read: "Worn brake heads without such wear plates may have same applied when distance between lugs has reached 2 in., for which charge in permissible."

Reason.—To refrain from the application of wear plates until, by reason of wear, the distance between lugs has reached 2⅛ in. is wasteful. To conserve material wear plates should be permitted and encouraged just as soon as sufficient wear, enabling the insertion of the thinnest wear plate is possible.

Rule 66

In Par. (c) of this rule, provide for 1½ in. stenciling instead of 1 in.

Reason.—To make a uniformity as to stenciling for air brakes and journal box repacking.

Rule 69

Revise Par. (a) to read: In machining wheels and axles, and the mounting of same for interchange service, the A. A. R. standard wheel shop practices as published in the Wheel and Axle Manual must be followed. In addition thereto, and etc.

Reason.—Effective date of adoption is immaterial, however it is thought the rule should state where the requirements can be found, i.e., the Wheel and Axle Manual.

Rule 98

Revise Sec. (c) Par. 5 to read: Serviceable experimental cored hub wheels marked "A. A. R. X." when removed from service on account of defect in axle or mate wheel, shall be credited as scrap except when removed on account of Rule 32 or Rule 84 condition (responsibility of repairing line), in which event secondhand credit must be allowed for such undamaged wheel or wheels. Such wheels when subject to scrap credit shall be held and disposition requested from car owner. If car owner elects to have wheels returned, freight charges collect, shipping instructions must be furnished within thirty days from date of notification. No credit should be allowed for wheels so returned.

Such undamaged wheels removed on authority of defect card (other than repairing lines card) shall be credited as scrap and reported as "Scrap per Par. 5 Sec. C, rule 98. The line against which the defect card is issued shall, upon receipt of bill, authorize the car owner to bill for secondhand value of such wheels."

Rule 101

In Item 172, transfer labor, per hour, from this material rule to Rule 107, the labor rule.

Reason.—For more ready reference.

Rule 112

Amend Sec. A, Par. 1 (a) as follows: Following the

(*Continued on page 495*)

Locomotive Maintenance Officers' Association

J. E. Goodwin,
President

The problems of those responsible for the maintenance of motive power are discussed in three reports to the association which deal with the selection and training of supervisory personnel, wartime maintenance of locomotive air-brake equipment, and a survey on metal cutting tools

WITH locomotive mileage soaring each month to new heights the necessity of restoring that run-out mileage through repair programs has placed on the repair forces of the back shops and enginehouses a responsibility of such proportions as to leave very little time to devote to matters other than running the railroads. Recognizing, however, that the only substitutes for shortages of men, facilities and materials are the more efficient utilization of those we now have, the Locomotive Maintenance Officers' Association committees and members collaborated in the preparation of reports, which are presented here, on several subjects of vital importance at this time.

The report of the Committee on the Selection and Training of Supervisory Personnel covers this important phase of mechanical-department work in a comprehensive manner, including many suggestions of real practical value. The maintenance of air brake equipment, contributing as it can to the elimination of road failures, is treated in a second report.

F. J. Topping,
First Vice-President

S. O. Rentschler
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Superintendent Motive Power,
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Wartime conditions, with the resultant shortages of materials and supplies, is causing many a hardship and in the railroad shop, where such a large and important part of the work depends upon machining operations it was but natural to expect that, with defense industries demanding an ever-increasing supply of the high-production metal-cutting tools, the railroads might have to take the short end, so to speak. However, the conditions that have existed in the past year have proved to be a blessing in disguise and the report of the Committee on Shop Tools, dealing with the cutting-tool problem, presents a survey of a situation in the shop field that can be used to advantage by every shop man who has anything to do with the machining of metals.

A fourth committee has in preparation a report on the facilities required for the maintenance of Diesel-electric locomotives. Unfortunately this report could not be completed in time for presentation in this issue.

Officers of the Association

Under the terms of the association's constitution the elective officers and executive committee members will hold over. The officers of the association are: president, J. E. Goodwin, mechanical superintendent, Missouri Pacific, St. Louis, Mo.; first vice-president, F. J. Topping, master mechanic, Chesapeake & Ohio, Hinton, W. Va.; second vice-president, S. O. Rentschler, shop superintendent, Missouri Pacific, Sedalia, Mo.; third vice-president, C. D. Allen, master mechanic, Chesapeake & Ohio, Silver Grove, Ky., and secretary-treasurer, C. M. Lipscomb, assistant to production engineer, Missouri Pacific, North Little Rock, Ark. The members of the executive committee are : F. J. Topping, (chairman) George Crowder, superintendent motive power, Georgia & Florida, Douglas, Ga.; E. J. Kueck, mechanical engineer, St. Louis, Southwestern, Pine Bluff, Ark.; W. P. Buckley, shop superintendent, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.; W. E. Vergan, supervisor air brakes, Missouri-Kansas-Texas, Denison, Tex.; G. A. Silva, shop superintendent, Boston & Maine, North Billerica, Mass., and G. E. Bell, general foreman, Illinois Central, McComb, Miss.

The association's advisory board consists of P. O. Christy, general superintendent equipment, Illinois Central, Chicago; D. S. Ellis, chief mechanical officer, Chesapeake & Ohio, Pere Marquette and Nickel Plate, Cleveland, Ohio.; O. A. Garber, chief mechanical officer, Missouri Pacific, St. Louis, Mo.; J. Roberts, managing director, National Railways Munitions, Ltd. (formerly chief of motive power and car equipment, Canadian National) Montreal, Que., and D. J. Sheehan, superintendent motive power, Chicago & Eastern Illinois.

* Mr. Roberts is now managing director of National Railways Munitions, Ltd.

Wartime Maintenance of Air Brake Equipment

Standards of inspection and maintenance should be higher under present conditions to insure against failures

By A. Malmgren

Road Foreman of Equipment, St. Louis-San Francisco, Springfield, Mo.

A. Malmgren

The necessity of meeting the transportation demand of the present, wherein the railroads of the United States are a part of our national defense system, requires that locomotive air-brake equipment be given more rigid tests preliminary to being despatched, that the representatives of management and the operators of equipment know that it is functioning properly within a range of insured safety. We cannot, at the present time, relent in our efforts to maintain a high degree of efficiency in the maintenance of brake equipment, because later we may be called upon to release trained personnel to the armed services and replacement will take months, even years of special training. During this training period, there will be a lower standard of maintenance. Too, we are being called upon daily to repair and keep in service more of the older equipment due to material shortage.

Maintenance means the dismantling, cleaning, repair and replacement of any of the working parts that are not functioning regularly or that can not be depended upon to function at all. It has been suggested by some that we ease up on tests at inspection periods so that equipment can remain in service during these troubled times, when material and man power are badly needed in other fields. No other field is any more important than the transportation field. I once heard a prominent speaker say, "There is no such a thing as a shortage of food, when one half of the world is starving for things that the other half of the world is over-producing. What is needed is a better system of transportation." To get better transportation, we must maintain our locomotives at a high standard so the operator of the equipment can place dependency on the equipment to function properly.

The most disheartening task confronting an engineman when handling the fast trains of today, is to have the brake equipment fail to apply properly or apply in emergency when only a service application was intended. An engineman may be ever so clever in his practical knowledge of the air-brake system—every feature of its construction, function, relation and operation—but if the equipment is not properly maintained, all his experience, knowledge and training go for nothing. Faulty functioning of equipment results in the loss of schedule time, reflects on the low standard of maintenance and encourages the repairman to continue to neglect his duty.

Here is a list of the various tests of the locomotive air-brake equipment that has proved helpful on our railroad and will prove helpful to others.

Before despatching a locomotive, the supervisor in charge must know that the engine and tender air brakes, signal equipment and air-operated devices have been inspected and tested and are in a safe and suitable condition for service; that the compressors are in condition to provide ample air for the service for which the locomotive is to be used; that the devices for regulating or controlling pressure are functioning properly; that brake valves work properly in all positions; and that all the water has been drained from the air-brake system. Examine carefully the cab cards, noting that cleaning dates of the various parts of the equipment are not past due. Measure the piston travel and examine the foundation brake rigging, reporting irregularities which must be corrected. At least once each month, unless otherwise instructed, all compressors, except the 8½-inch cross-compound compressors, should be laundered, strainers cleaned on locomotives not equipped with the Type C filters, and orifices checked.

Periodic Inspections

In addition to daily and monthly inspections and test, the following quarterly inspection and test should be made. Test all air gages on the dead-weight tester, dismantle, clean, test and adjust compressor governor and feed valves, dismantle, clean, and test the vent valves.

In addition to the preceding inspections, the following inspections must be made on each six months' period. Dismantle, clean and test brake valves, control valves, distributing or triple valves, emergency relay valve, double checks, safety valves and signal equipment.

On annual inspection dates in addition to the tests outlined in daily, monthly, quarterly and semi-annual inspections, all the reservoir must be subjected to a hydrostatic test and hammer test.

Classified Repairs

All brake cylinders must be overhauled when locomotives are undergoing classified repairs. Brake cylinders must be replaced when the diameter of the cylinder exceeds the original diameter 3/32 in.

Daily Comparison Test

Apply standard test devices to the brake pipe and signal hose; see that the locomotive air gages are tight on the brackets and that the dial glasses are clean and tight; make sure that the dials are readable and that pipes are properly connected and have no leakage. Place the automatic brake-valve handle in release position and note whether or not there is more than 2 lb. variation between main-reservoir, brake-pipe, equalizing-reservoir and test-device gage hands. Should there be more than 2 lb. variation, gages must be removed and corrected. Brake-pipe and equalizing-reservoir gage hands should compare within 2 lb. of that of the test gage at the following

pressures: 90 lb., 70 lb. and 50 lb. Make a 10-lb. brake pipe reduction and brake-cylinder gage hand should indicate approximately 25 lb., increase brake-pipe reduction to 20 lb. and note that the brake-cylinder gage hand increases to approximately 50 lb. A more accurate method for testing the brake-cylinder gage is to attach a test gage to the pressure head of the brake cylinder and compare the engine brake-cylinder gage reading with that of the test gage. Locomotive air gages must be tested at least once each three months; also when any irregularity is reported. Gages found incorrect in reading should be corrected before they are returned to service.

Automatic Control, Distributing and Triple Valve Tests

(a) Have the automatic brake valve in running position and know that the equipment is fully charged. (b) Open 3/64-in. orifice in the test device; then place the automatic brake valve in lap position. (c) Engine and tender brakes should apply within the first 5 lb. of brake-pipe reduction. If the brakes do not apply, repeat the above test except that the automatic brake valve should not be in lap position; instead, close the double-heading cock and see that the brakes apply within the first 5 lb. of brake-pipe reduction. Should the automatic control valve, distributing valve or triple valve fail to pass the above test, it should be removed and repaired. Control valves, distributing valves and triple valves should be cleaned as often as conditions require to keep them in a safe condition for service, but not less frequently than once each six months.

Brake Rigging

Note that the foundation brake rigging is maintained in a safe and suitable condition for service; that all levers, rods, brake beams, hangers, and pins are of ample strength; that they do not foul in any way that will affect the proper operation of the brakes and that they clear the rail at least 2½ in., and preferably 3 in. or more. See that all pins are properly secured in place with cotters, split keys or bolts. See that brake shoes are properly applied; not worn out; secured by a brake shoe key and are in line with the tread of the wheel.

Brake Valves

Automatic, independent and straight air: Move the handle to all positions to make sure that the handle operates easily. If it does not, lubricate the valve, key gasket, and handle latch. In case the brake valve is hard to operate after being lubricated, it should be removed, cleaned and repaired. The brake valve should be securely anchored and pipe connections tight. A constant blow at the service exhaust port of the automatic brake valve when the handle is in release or running position, indicates that the equalizing discharge valve has dirt under its seat or the valve is defective. In many cases the dirt can be removed or blown off the valve seat by making a heavy service application and then releasing. To test the rotary valve leakage, make a 20 lb. reduction and lap the brake valve. If the brake-pipe pressure increases, it indicates that either the rotary valve, brake-valve gasket or dead-engine feature is leaking.

Release Position

With the brake valve in this position, a warning port blow should be heard from the exhaust at the back of the brake valve. Open the front or rear angle cock and a strong continuous blow should be obtained at the hose and main-reservoir pressure should fall at a rapid rate.

Running Position

The compressor governor and brake-pipe feed valve should maintain the proper pressure in the main reservoir and brake pipe for the service to which the locomotive is assigned.

Lap Position

The brake-pipe pressure and equalizing-reservoir pressures should not increase above the predetermined pressure for the service to which the locomotive is assigned when the brake-valve handle is in running position. The brake-cylinder pressure should not build up and the main-reservoir pressure should be controlled by the maximum head of the governor.

Service Position

The equalizing piston should raise promptly after the handle of the brake valve is moved to service position and seat properly when the handle is returned to lap position. Also, there should be no leaks from the brake-valve service exhaust port. When making a service application, the time required to reduce the equalizing-reservoir pressure 20 lb. should be noted and must be maintained within the following limits: From 70 lb. pressure to 50 lb., 9 to 11 sec.; from 90 lb. pressure to 70 lb., 7¼ to 8¼ sec.

It should be noted while making a 20-lb. continuous reduction that an intermittent exhaust of air is obtained at the brake pipe exhaust. If only one long drawn out exhaust of air is obtained, it is an indication that the equalizing-piston ring or bushing is leaking.

Emergency Position

Note that emergency action is secured and that the discharge from the brake valve is regular. Brake-cylinder pressure should increase at a more rapid rate than that obtained with a service application and the safety valve should be functioning with the E-T or L-T equipment.

Compressor Tests

All compressors must be given an orifice test in accordance with I. C. C. Rule 107. Close the main-reservoir drain valves and start the compressor slowly; close the compressor drain valve and start the lubricator feeding. Gradually open the steam throttle to the compressor and note that the main-reservoir pressure builds up at a normal rate. Observe the performance of the compressor for even strokes; correct any leakage at the piston-rod packing; note that the compressor does not pound; see that the air-valve cages are tight; note that the steam-cylinder heads are tight and not leaking and that the air strainers are clean and tight. Know that lubricating devices are working properly for the steam and air ends of the compressor.

Feed-Valve Test

Reduce brake-pipe leakage to minimum. At no time should it exceed 3 lb. per min., using the brake-pipe gage to check. Charge the brake pipe to standard pressure with the brake valve in running position. Open the 3/64-in. orifice in the brake-pipe test device. The feed valve should not show a fluctuation of more than 1 lb. from standard adjustment on the test gage. At the completion of range test, close the 3/64-in. orifice, empty the brake pipe and leave the handle of the automatic brake valve in lap position. Open the 9/32-in. orifice in the rear brake-pipe hose test device, close the double-heading cock and place the handle of the automatic brake valve in running position. Open the double-heading cock and note that it does not require more than 3 sec. to restore

the brake-pipe pressure from 0 lb. to 65 lb. on the locomotive gage. Observe the test gage and note that the pressure is retained above 65 lb. on the test gage.

Compressor Governor Test

To test the excess-pressure-head (low-top) and single-top governors be sure that the steam throttle to the compressors is wide open before starting the test. The automatic brake valve handle should be in the running position. See that the proper excess pressure is maintained and that the governor responds within a 3-lb. range. To test the maximum-head (high-pressure-top) E-T or L-T equipment, place the handle of the automatic brake valve in lap position. Observe that the compressor stops at the pressure to which the maximum pressure head is adjusted and that it responds within a 3-lb. range. Be sure that the governor vent port is open and not blowing excessively and know that the pipe connections are not leaking.

Signal-System Test

Determine by inspection that the signal system is free from leakage by closing the signal cut-out cock. Check the leakage with signal test-device gage. Leakage should not exceed 3 lb. per min. from a standard pressure of 42 lb. and this pressure must be maintained. Signal equipment is considered in good condition when four whistle blasts can be obtained in 30 sec. or less by opening the $\frac{3}{64}$-in. orifice in the test device intermittently.

Vent-Valve Test

Start all tests with the handle of the automatic brake valve in running position; the main-reservoir pressure at 110 lb. and equipment charged to 70 lb. Open the $\frac{9}{32}$-in. orifice in the test device and leave it open. Then, with as little lost time as possible, the operator should move to a position where he can operate the automatic brake valve easily. Move the handle of the brake valve to lap position. The rapid drop of brake-pipe pressure should cause the vent valve to open. Close the rear angle cock or orifice test cock. Move the brake-valve handle to lap position long enough to permit the main-reservoir pressure to increase to 135 lb. Then move the brake-valve handle to release position only long enough to permit the brake-pipe pressure and main-reservoir pressure to equalize. Move the brake-valve handle to service position and reduce the brake-pipe pressure to 50 lb. in one continuous reduction. The vent valve should not operate. Vent valves failing to pass the above tests should be removed, cleaned and repaired.

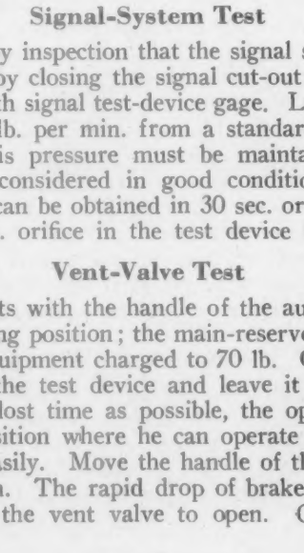
Cleaning and Repair

Any part of the locomotive air-brake equipment that does not meet the various tests, must be removed from the locomotive, cleaned and repaired. Cleaning does *not* mean that the operating parts just be wiped off with a clean cloth but instead the part must be dismantled, the castings put through a cleaning solution, rinsed and then allowed to stand in a vat of hot paraffin. This permits the filling of the porous part of the casting and prevents small leaks. The moving parts of the equipment should be run through a cleaning solution, the valves faced and the seats trued. Pistons and piston stems or rods are put in lathe to see that they are true. Piston-ring grooves are trued; bushings ground and rings of proper size applied. With the use of proper tools and intelligent training of repairmen, a fine finish can be applied to all frictional surfaces. By the use of a good lubricant, leakage past the sliding surfaces as well as frictional resistance between moving parts, will be greatly reduced. After assembly of the air-brake equipment, it should be given more rigid tests on a test rack than that required in service.

These are methods that are being successfully employed on our road and they have been a help not only in keeping motive power in daily service, but in bringing about a reduction in the cost of air-brake maintenance. This much every engineman, repairman, foreman and supervisor owes the management, public and government.

Report of Committee on Shop Tools

Tool conservation and the use of carbides has centered attention on the necessity for proper tool room facilities



Anneman-Mott Studio

E. A. Greame,
Chairman

The report of this Committee at the 1941 meeting dealt with the experiences of a group of 23 railroads with respect to the use of high-production tool steels in the machining of locomotive and car parts. The data which were presented in that report indicated that the railroads were utilizing high-speed, alloy and carbide cutting tools on a wide variety of machining operations and were either effecting material economies in production time or extending tool life, between grinds, to entirely new limits.

In presenting last year's report to the Association, it was recognized that priority control of tool steel by the War Production Board would, in all probability, operate to limit the extension of the use of high-production tool steels, particularly of the carbide type, and that the railroads would experience such difficulties as to warrant early experimentation with substitute cutting tools. The present report was planned with the idea of finding out what substitutions have been and could be made and the manner in which they are performing.

In order to confine the scope of the Committee's survey to questions of maximum value under war-time conditions, the answers to four questions were sought. These were: (1) What difficulties have been experienced

in securing tool steels ordinarily used; (2) to what extent have the roads been able to secure carbide tools; (3) what tool steels are being used as substitutes for those formerly used, and (4) has experience with the substitutes been satisfactory?

Results of the Survey

Question No. 1—Practically all of the replies indicated that difficulties are being experienced in securing tool steels of high tungsten or cobalt content. Deliveries of supplies have been slow thereby creating a condition where means have had to be taken to solve immediate problems. That our shops and tool rooms have been equal to this task may be seen by some of the comments contained in this report. It is apparent that one of the first jobs done was a thorough house cleaning with the result that many roads found excess and discarded tools, all of which were gathered up and sent to the central tool rooms. Where solid shank tools were, in many cases, made up of high-grade steel these tools have been drawn down and applied as tips to carbon shanks with the result that the ultimate supply of tipped tools has been greatly increased. Many machine tools are equipped with tool holders of types for which it is now difficult to get tool bits. The tipped tool has helped to solve this problem. Many pieces formerly looked upon as scrap are now utilized as tips. This helps to conserve stocks of new tool steel on hand.

Question No. 2—There seems to be some conflict of opinion as to the ability to get carbide tools. In the case of some roads which reported their inability to secure carbide tools further questioning leads to the conclusion that a sufficiently strenuous effort had not been made for other roads report that, to date, they have had no difficulty whatever in getting carbide tools in reasonable quantities. One road reported a rapid expansion of the use of carbides since last year and, in replying, stated that "the use of these tools is limited only to the extent to which we can train our men in their proper grinding and use. In several shops carbides are used almost exclusively on tire boring, driving-box bearings, turret-lathe work and vertical-turret-lathe work.

Question No. 3—Replies to this question indicated that practically all substitutions have been in the nature of tool steels of low tungsten content replacing those of higher content such as a tungsten molybdenum high-speed steel with approximately five per cent tungsten in place of the 18-4-1 type. It is interesting, however, to note the fact that some shops report the substitution of carbides for high-speed steel.

Question No. 4—All replies indicated a general satisfaction with the performance of substitute steels and in some cases the substitutes have proved to be even better than the cutting tools formerly used. A shop which has installed special equipment for grinding carbide tools reports such satisfaction with present performance of carbide tools that a return to the use of high-speed tools is doubtful. Many replies stressed the importance of modern tool heat-treating equipment and the efforts now being made to obtain such equipment. The many references to the proper grinding of tools and the proper equipment with which to do it indicate that the campaigns of recent years on the part of manufacturers of tool steels to promote the idea of proper tool grinding are now bearing fruit in the form of better machine and tool performance.

How One Shop Meets the Situation

The reply from one shop superintendent summarizes the situation with respect to tool steel so well that it is quoted, in part, as follows:

"Now that high-speed steel is practically unobtainable for railroad shops, it is both surprising and gratifying to note how quickly our shop forces are adapting themselves to the new conditions, making the most of the existing stocks of high-speed steel and the substitutes which are available. Up to a year ago, solid tools, worn-out cutters, dies and reamers, etc. could be found around all machines and in tool boxes; now anything larger than vest pocket size is taboo.

"The life of cutting tools is being multiplied several times by the development of cements and fluxes for the cementing of high-speed tips onto carbon steel shanks, with proper care there being no excuse for scrapping any piece weighing more than a few ounces. Most all shops have had experience in cementing tool bits for lighter work, but it is only recently that this practice has been developed satisfactorily for heavy-duty tools. For example, it is not so long ago that solid high-speed tools 3½ in. by 1½ in. by 18 in. long were considered necessary to turn tires—now we are using a piece 1½ in. round by 1 in. thick, weighing only a few ounces, cemented on to a forged tire-steel shank, with excellent results. Experience has taught that forged tire steel of any size makes an ideal tool shank, as a separation is liable to occur between the bit and shank on the heavier cuts if a softer steel is used.

"If properly heat-treated, there is no reason to make any change in the feeds, speeds and depth of cuts from what were previously used with the solid tools; also, the tips can be ground down almost to the shanks before failure occurs. Another advantage is that there is no wear-out at all to the shank. Tool bits of standard sizes can be forged and kept in stock ready for application and can be put back in service just as quickly as by reforging a solid tool.

"We are not forgetting the fact that if the emergency exists for some considerable time, even by these methods of using up every ounce of steel available, there is going to be a time when these stocks are going to be depleted. Considerable experimenting is being done with molybdenum steels in order not to be caught short. On light work, such as turning and boring steel pins and bushings, there are no complaints with molybdenum, but on heavy or intermittent cuts, especially on cast steel where sand is encountered, we have not been so successful. Our experiences along this line, however have been limited.

"To date we have had no difficulty in procuring carbide tool bits and since they have been in constant use for several years in the local shops, our foremen and men are fairly well trained in adapting the various grades to suit the conditions.

"It has been found that while the manufacturer's manual usually gives the grade to be used in cutting different metals, to get the best results there are other conditions to be considered, such as the condition of the machine. For instance, a hard grade bit might be satisfactory on one machine and would break down on another machine cutting the same metal. Frequently carbide tools have been condemned because sufficient thought has not been given to the machine condition in selecting the grade.

"Proper grinding of tool bits to suit the metal to be cut is important; on intermittent cuts, entirely different top rakes and side angles are required to take the shock away from the point of tool. There is an article entitled "Using Carbide Tools On Large Machine" in the August, 1942, issue of the *Railway Mechanical Engineer*, page 357, by Fred. W. Lucht which covers this subject thoroughly.

"In the past the cost of carbide tools was almost prohibitive, but now that the price is considerably lower and high-speed steel is unobtainable, there is no doubt

that the use of carbides as a substitute will be increased. Briefly, our present practice is as follows:

"*First*—Collect all solid pieces of high-speed steel and forge into tool bits. Results: No loss in cutting time.

"*Second*—Use carbide tool bits wherever machine and work conditions will permit. Results: Cutting time frequently decreased.

"*Third*—Molybdenum steels have been found quite satisfactory on light work, using the same speeds, feeds and depth of cut, but our experience is limited on heavier work."

Centralized Tool Control System Needed

The present situation with respect to cutting tools is serving to show the importance of a centralized tool control method for a shop, or a railroad system. The very shortage of high-production cutting tools has increased their value to a point where every effort is being made to conserve them; to use them properly and to get from them the full measure of their capacity to cut metal. Scarcity has made obvious the fact that certain practices, indulged in when materials were plentiful, can no longer be tolerated.

Among the facts that experience of the past year has developed are: (1) That cutting tools, regardless of type can do a better job of producing if they are properly designed, properly heat treated and properly ground; (2) that the wider experience of tool steel manufacturers qualifies them to make recommendations which the railroads, as users, can well afford to follow in the effort to conserve these vital materials; (3) that it is not possible to furnish machine operators with tools of maximum efficiency unless the tool room is adequately equipped with heat-treating and tool-grinding equipment at least as modern as the tools which are now being used, and (4) that every effort should be made to secure such equipment as a guarantee that production will not be curtailed because of a bottleneck in the tool room.

The report was submitted by a committee composed of E. A. Greame, (chairman), tool foreman, Delaware, Lackawanna & Western, Scranton, Pa.; W. W. Brown, shop supervisor, Boston & Maine, N. Billerica, Mass.; W. Hurst, supervisor shop machinery and tools, New York, New Haven & Hartford, Readville, Mass.; E. J. Kueck, mechanical engineer, St. Louis Southwestern, Pine Bluff, Ark.; F. Perkins, shop superintendent, Grand Trunk Western, Battle Creek, Mich., J. I. Stewart, supervisor shop machinery and tools, New York Central, New York, and J. P. Christiansen, Chicago, Indianapolis & Louisville, Lafayette, Ind.

Finding and Training Good Supervisors

Potential supervisors are usually found in the ranks but it requires a carefully planned training program to develop them

F. K. Mitchell,
Chairman

The committee, selected to prepare this report, has considered that its obligation to produce a worth while work is accentuated by the acute need arising through the present war emergency. It felt that while the subject has always been pertinent, the load on industry and railroads alike, placed there by the demands for production and transportation incident to the war effort, will only be met as successfully as is the supervisory personnel problem. With that obligation assumed, it herewith proceeds to present for your consideration the best plan and procedure its members are capable of formulating.

Basically, the first element of the problem is raised in the question—"What kind of material must be obtained, what qualifications must be present in the candidate for a supervisory position?"

Personality the Vital Factor

Contrary to the usually accepted premise, the committee feels that the first necessary attributes are found in the realm of that almost indefinable qualification called "personality." We hold that above all, in the selection of a candidate for a supervisory position, such a one as will not only be successful in handling a minor job, but as may also be depended on to be equally successful in the discharge of duties through a range of successively more important positions, should be appointed, and that no candidate without personality can be expected to fill that requirement. We shall not attempt fully to define this so-called "personality," but only to give you those components which in our opinion constitute its most important elements. These we have designated in what we believe to be the order of their importance from the point of view of this discussion. They are, first, honesty and sincerity; second, the ability of the candidate to get along with his fellowmen; third, appearance; fourth, address; fifth, alertness and enthusiasm; and sixth, initiative.

The next group of qualifying attributes in order of importance might be classed under the general heading of "background," or those good indications out of the past that may well point toward the possibility of equally good or better things in the future. Realizing full well that many a fine character has come from a family of ne'er-do-wells, we still feel that the best selection in the long run will be that of one who comes from a good substantial family. Following almost the same line of logic and experience, one with at least some religious conviction might well be chosen. Now, more than ever in the past, we feel that at least a high school education is essential. Further, it is desirable that our future

supervisor should have evidenced a keen interest in diverse affairs and even more desirable that he have evidenced some tendency to leadership in one or more fields, be it social, religious, athletic or civic.

The man we are looking for must be valuable over a long period of years, and to be so he must have good health and physical stamina. We expect to invest a great deal in him, and it is logical that if we expect to profit through such investment, he should have those attributes. Since he will be called upon to use his eyes a great deal, it is not too much to demand that they should test at least 20/20 without glasses. He should have no objectionable deformities or any hereditary or communicable diseases and his general health should be good. It might even be well for him to be moderately participant in some athletic activity.

Since the man we are looking for is to serve as a mechanical department supervisor, he should have a natural liking for things mechanical. It is essential that he be fairly good in mathematics, for his every day problems will involve their use. It is also desirable that he be mechanically analytical, and likewise mechanically creative.

Where Shall We Look For Supervisors

Having reached some definite conclusions as to the kind of material we are looking for, it will not be amiss to consider where we are apt to find it. Generally speaking, it is going to come from one of two sources. The first, and most desirable source, from many points of view, is within the ranks of our own organizations. If it can be found there, the esprit de corps of any organization will be benefited. It may come from the ranks of mechanics already employed as such, from among the regular apprentice group, or from the special apprentice group where technically trained men are afforded such special training. If not found at all in these groups, then we must look outside our own organizations, to high schools, trade schools, co-operative schools, colleges and in exceptional cases to outside industries.

The next phase of our problem is the procurement of the kind of material we know we want from the sources available. Here again two distinct problems are presented. First, let us consider the procurement from among our own ranks.

The Importance of Personnel Records

Essentially, adequate personnel records must be maintained. Often the material we are seeking is buried just under our noses. A parallel might be drawn from the experience of one railroad when the supply of scrap iron and steel became inadequate. One official remembered that an old site where a car shop had been operated for years and then abandoned, had been filled in without any attempt to remove the old rail and other scrap. They ploughed up the site at his suggestion and tons of scrap were brought to light. Adequate personnel records will perpetually turn up the much needed supervisory material which might otherwise become buried in any organization.

Secondary to such records in value to our problem comes the supervisor who knows intimately the men who work for him and their qualifications and possibilities. Such a supervisor can be of untold value in keeping management advised as to the potential supervisors in the ranks. In order to make all supervisors equally valuable, it is suggested that each and every supervisor be required to recommend to his immediate superior at least two men in his gang or department who are qualified to act in his stead or succeed him in event his position becomes vacant through promotion or otherwise. One means of making such selections less difficult is to make the supervisor s job attractive to others. To this end, the establishment of proper rates of pay and spread of rates should be under constant consideration. Another method is to accord the supervisor proper deference and prestige. A third is to design apprentice courses so that every apprentice will be inspired to desire more than a mechanic's job.

The problem of procurement of supervisory material from outside sources has a large element of salesmanship involved in it. Your company must be sold to those agencies from which the procurement can be made and to those candidates brought to your attention by such agencies. This may be done in a number of ways. Apprentice instructors and shop superintendents should keep in close contact with local high school and college personnel officers. Furnish them with information concerning your training courses and chances of advacement. Through them contacts may be made with students having the proper qualifications.

It is suggested that such methods as the encouragement of inspection trips by students of local schools through company shops in order to instill interest might well be productive of favorable results. Through interviews, by properly qualified officers with prospective apprentices while they are yet in school, both parties will benefit. If such interviews are properly conducted—not merely made a quiz—the student will learn better whether he is fitted for the kind of work being offered and the interviewer will have a chance to find out whether the candidate can qualify. Carry the procurement to the candidate, don't wait for him to come to you! In this day and age if you wait, the other company will get the best and you will get what is left. This principle will apply equally as well where the rules require sons of employees to be given preference.

Some thought should be given here as to how extensive procurement effort should be. The endeavor to locate satisfactory supervisory material among the ranks of your existing employees should, of course, be diligent and unceasing. The effort to secure it from outside sources should be gauged by your success within your own organizations. Procurement from outside sources should only be in numbers necessary to augment the deficiency from within. At all times the proper balance between technical and non-technical graduates should be maintained.

Training of Supervisors

Assuming that we are able to procure from the available sources potential supervisors in required numbers, the next step is, of course, properly to train them for positions of responsibility. This problem logically divides itself into two phases—the development of supervisory ability before and after the initial appointment.

It has been aptly said that "as a twig is bent, so the tree is inclined." The same applies to the development of a supervisor. The initial stages of his service with your company, which usually will be during his apprenticeship, may well be considered as all-important. Hence, too much thought and effort cannot be directed toward developing an apprentice training system which will not only inspire the desire to become supervisors, but also inculcate in the apprentice those traits and ideas which are known to be essential to good supervision.

With that idea in mind we offer the following suggestions: First, that all problems put up to the apprentice both in school and in the shop be related to some phase of shop or railroad activity which he may need to know about in the future. For instance, rather than have him figure the area of a circle 11 in. in diameter let the prob-

lem be to find the cross sectional area of an axle bearing 11 in. in diameter; and in the shop, rather than have his first lesson on a shaper be to plane a piece of steel to ½ in. by 5 in. by 8 in., let him make a crosshead liner of the same dimensions, explaining to him where, how and why it is to be used. Provide lectures on shop problems and operations based on the same general idea, avoiding the abstract and emphasizing the practical. Do not restrict his advance nor the nature of his work to the average of all apprentices, but let him advance as rapidly as his capabilities will permit. Subtly, yet continually, keep each reminded of the successes of former apprentice school graduates. Reward fittingly each apprentice for his interest and progress. When he is sufficiently advanced, let him act as an assistant instructor during the school hours and in the shop assign him special work which will cause him to feel that his foreman believes him to be trustworthy.

Apprentice Clubs

No greater help in the creation of supervisory material at this stage can be devised than the apprentice club. Management should sponsor the clubs but the apprentices should be allowed to run them. By observation of how they are managed—who takes the leading parts—valuable information as to the ability as leaders which various boys possess can be obtained. It has been suggested that one logical scheme might be to suggest that the club offices be given names corresponding to railroad positions, and while a boy holds such an office he be sponsored by the shop supervisor having the same title. To maintain interest in club matters at the proper height, and, at the same time, show its appreciation of the activities, management might well sponsor such activities as club trips to other shops, model building, and so forth. Finally, management should give the apprentice club all possible publicity in local, railroad and national publications.

Extra-curricular work for apprentices should be made available. They should be encouraged to take advantage of correspondence courses and night courses offered by schools and universities in the vicinity. After-hour shop forums on vital railroad problems and operations, if wisely conducted, will likewise afford an opportunity for development of address and the ability of the apprentice to express himself clearly before others.

Consultation between the apprentice and his sponsor has been found to be of eminent value. Here both may profit. The apprentice, through this medium, has a chance to find the answers to problems which are vague to him and the sponsor has an opportunity to learn more and more about the latent abilities in the apprentice and how best they can be developed.

Two Important Suggestions

All of the above suggestions may be of little or no avail unless two very important additional things are done. The first of these is to establish, by suggestion and example, that all supervisory appointments are made on the basis of qualification and merit. The second is that an adequate system of reports and records, covering all activities and qualifications of candidates, be maintained so that no error in judgment is likely when the candidates for any position are being weighed.

Often an extended period of time may elapse between the time of an apprentice's graduation and the occurrence of a supervisory vacancy. During this period his interest and desire for a better position must be maintained. He should be encouraged to participate in safety, first aid, social club and other activities. He should be consulted by his immediate superior on any matters pertaining to his gang or department and, where possible, his ideas used and he be given credit for them. As the occasion arises, he should be given an opportunity to fill in on temporary minor supervisory vacancies and an accurate record kept as to how he conducts himself.

Proper Procedure in Making Appointments

The committee does not feel that the question of the actual mechanics of appointment of the supervisor is essentially a part of its problem but would, however, like to suggest that in all cases the original recommendation should come from the candidates' immediate supervisor, if such supervisor is known to be qualified to make the recommendation. Next, that the head of the department in which the appointment is to be made have opportunity to approve and do so only after satisfying himself that the candidate has the necessary qualifications and that his recommendation was made on that basis and under no consideration on the basis of personal friendship, relationship, religion or politics. The officer charged with final approval should not only consider the merit and qualifications of the candidate as reflected by personnel records and what personal knowledge he has of these, and on the basis of impressions obtained by interview, but should consider how the candidate's personality will fit with that of the man to be his immediate superior.

The final consideration, and by no means that of least importance, which we wish to deal with, is the development of the supervisor after his appointment as such.

Our first thought here is really tied up with the actual appointment, and that is the important fact that any supervisor should be appointed only to a job which is within his capabilities of handling. Many a fine prospect has been ruined by failure to consider that too great a step forward may break the spirit of some candidates by imposing more of a load than they are yet ready to carry, and in other cases may cause the candidates to get an exaggerated opinion of themselves. Either situation is highly undesirable.

Coaching New Supervisors

Our next thought is that it should be recognized that he will need help. To this end we urge that he be given a complete understanding of his new duties and responsibilities. This may be done by conference with his new superior, but perhaps can best be done by leaving the man he is to relieve with him a few days so that the one can pass on to the other the benefit of each man he is to supervise. The new supervisor should also be given such literature as is pertinent to his job, such as shop schedules, working agreements, etc.

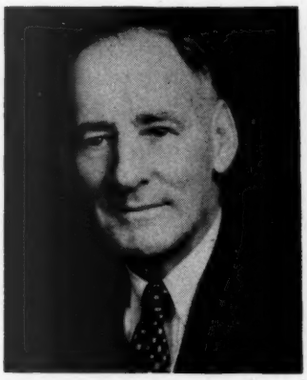
Our next thought is that the probable route of each supervisor's advancement should be pointed out to him in order that he may have opportunity to prepare himself. Urge that he do so through observation of others and study. Many roads are finding that help in this direction, by making available to all foremanship conferences and refresher courses, is highly beneficial. These are also found beneficial to management because of the opportunity they afford for observation of those who take advantage of them by senior supervisors who are constantly alert to spot such men as merit further advancement.

Here it might be well to offer an admonition against a practice which has often been followed more through shortsightedness and selfishness than for any other reason. It is—don't hold a supervisor, who is qualified for more highly responsible positions, on a job just because he is exceptionally valuable on that job. A diversity of experience will not only keep up his interest, hearten

(*Continued on page 494*)

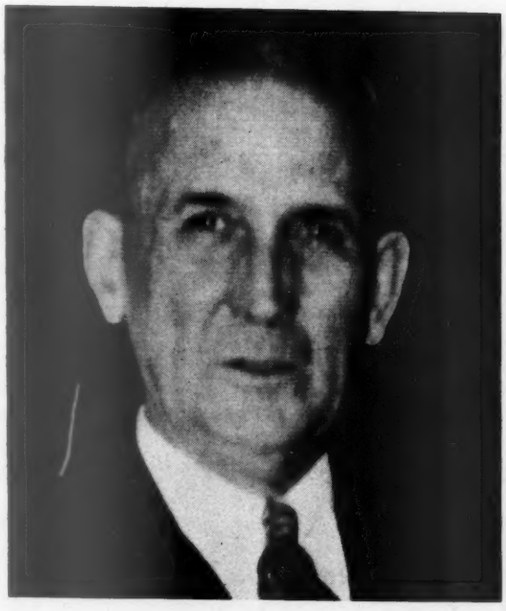
Railway Fuel and Traveling Engineers' Association

E. E. Ramey,
Vice-President



W. C. Shove,
Vice-President

T. Duff Smith,
Secretary-Treasurer



L. E. Dix,
President

Despite war-time difficulties this association presents a full complement of committee reports covering the entire range of its field—Reports deal with Diesel and steam locomotive performance, fuel, and motive-power utilization—President emphasizes demand for higher performance records

NOTWITHSTANDING the conditions which led to canceling the meetings of all of the coordinated associations which are accustomed to hold their meetings during the Fall at the same time and place and the difficulties in the way of holding committee meetings, the Railway Fuel and Traveling Engineers' Association has carried out practically a full program of committee reports, all of which will be published in the usual volume of proceedings by the association.

Reports were prepared on nine subjects which deal with air brakes, the handling of Diesel locomotives, steam locomotive firing practice, coal sizes, fuel records, fuel economy, and motive-power utilization. Gas-turbine progress is also reported.

Since no meeting of the association is being held this year, there has been no election of officers. The officers elected at the meeting of the association held at Chicago September 23 and 24, 1941, will continue to serve during the coming year. They are President: L. E. Dix, fuel supervisor, T. & P., Dallas, Tex.; vice-presidents:

E. E. Ramey, fuel engineer, B. & O., Baltimore, Md.; W. C. Shove, general road foreman of engines, N. Y. N. H. & H., New Haven, Conn.; secretary-treasurer: T. Duff Smith. The members of the Executive Committee are E. Holmquist, master mechanic, C. & N. W., Chicago; A. G. Hoppe, assistant mechanical engineer, C. M. St. P. & P., Milwaukee, Wis.; H. W. Sefton, superintendent locomotive and fuel performance, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind., and W. R. Sugg,* superintendent of fuel conservation and lubrication, Missouri Pacific, St. Louis, Mo.

Abstracts of the committee reports which will appear in the 1942 proceedings of the association are given below. These are preceded with a brief message from the president of the association pointing out the need for continued exertion.

President Dix Addresses the Members

He emphasizes particularly the fact that those who remain on the railroads have got to establish new performance records

Since our last convention war has been declared. Our first endeavor is to win this war. The members of this association play a most important part in the operation of our trains in a safe and economical manner. The railroads are doing a wonderful job, exceeding all expectations; the handling of war time freight and passenger traffic without congestion speaks for itself.

In every minute of the year 1941, the railroads moved an average of 904,000 tons of revenue freight one mile, the greatest volume ever handled in any corresponding period, by any transportation agency in the world; an average of 915 tons of freight was carried per train in 1941, the highest on record and an increase of 41 per cent compared with 1921.

You members of this organization who operate the locomotives, and you who supervise their operation, helped make that possible; and in the successful operation of our engines the fuel performance has not been overlooked; in 1941 records indicate, for each pound of fuel used in road freight service the railroads hauled nine tons of freight and equipment one mile, an increase of 46 per cent as compared with twenty years ago.

How has this record been attained? We say by the study and diligent work of the members of this association in past years. The papers read at our conventions and the discussions by the members have been very helpful in increasing the efficiency of locomotive operation with resultant fuel saving.

Many of the members of this association have been called into the armed forces of our country and many more will be called at some future date. Those of us who remain will be called upon by the railroads to improve upon the records that have been made. This will require hard work for long hours to do the things we should and will do to keep these railroads operating safely and economically.

Many new men have been employed on our locomotives and we must not make the mistake of forgetting that we, ourselves, were once student firemen or newly promoted enginemen. We must have patience with these new men, see that they are properly instructed in their work, impressing upon them thoughts of fuel economy and successful locomotive operation. These are the men who will, some day, take over our activities and duties in this organization.

Some of our railroads will, undoubtedly, be called upon to burn inferior grades of fuel, as in the last war—the railroads burning the slack, and the better grades going to the war effort; but through this association we have learned to handle and burn slack coal successfully and economically. But whatever our fuel problems of the future may be the papers which have been read and discussed at our meetings and those appearing in this volume will be helpful, indeed, to all of us.

It is, of course, to be regretted that we were unable to hold a convention this year, but perhaps a meeting can be arranged for 1943. Let us all hope this may be arranged as through these meetings much good has been conveyed to our individual railroads and more efficient locomotive and fuel performance have resulted from putting into practice the ideas and methods presented on the convention floor and discussed by the members.

Handling Diesel-Electric Freight Trains

The importance of care in starting and controlling slack emphasized—Brake applications should not be hurried

The freight Diesel locomotive is equipped with the well known Westinghouse No. 8-ET equipment having the KS-8-PA train-control brake valve with the double rotary valve and two cut-off valves, also a valve structure attached to the upper end of the brake valve pedestal, in which are located the application valve which functions to apply the brake pneumatically. A suppression valve is used to afford suppression of a pneumatic brake application for a predetermined time, if less than a full service manual brake application is made; a reduction-insuring valve functions to position the reduction suppression valve to permanently suppress a pneumatic brake application when a manual service brake pipe pressure reduction of 20 lb. or more is made. A recapture valve provides a "split reduction" of brake-pipe pressure during a pneumatic brake application by use of the first service position of the automatic brake valve. Operating in conjunction with this equipment is an electric pneumatic timing valve, several small volume reservoirs, etc. The equipment mentioned above used with the No. 8-ET equipment is to adapt the function-

* Mr. Sugg is now general supervisor of air brakes at St. Louis, Mo.

ing of the speed and safety control features used with the freight Diesel locomotive, and affects train handling only when permitted to operate pneumatically.

The 5,400 hp. Diesel-electric locomotives will handle a train of 150 cars, approximately 7,500 tons, where the grades, both ascending and descending, do not exceed 0.5 per cent, at speeds up to 50 and 60 m. p. h.

Starting Long Trains

It is important that the slack be controlled when starting, as well as when stopping. Changing slack, if not done properly, will result in damage to the lading and drawbars. It requires more time to release the brakes on a long freight train; therefore, ample time must be allowed for all brakes to release before attempting to start. After the brakes have released, the Diesel locomotive throttle should be placed in run (1) and allowed to remain in this position as long as the locomotive is moving and until it is known that the entire train is in motion. If the train cannot be started with the throttle in run (1) after waiting some 5 to 10 seconds the throttle should be advanced to run (2) and, after waiting 15 to 20 seconds, if the train does not start, move the throttle to run (3). The locomotive should start the train in run (3) even though it be a tonnage train and on ascending grades; however, if it will not start in run (3) after allowing ample time for full power development the throttle may be moved to run (4). Care must be exercised with the throttle in run (4) as the locomotive will develop sufficient power to break the train in two. Slacking should be avoided if possible; however, it is much better to take the slack than it is to build up excessive power endeavoring to start a train that has the slack stretched tight.

Often a train cannot be started with the throttle in run (4) and when the slack has been taken on the entire train it can be started with the locomotive throttle in run (2). If the slack has been taken on the train on grades where it is possible for a roll back, it must be known that the entire train is at rest before power is again used. Then use power moderately until all slack has been taken up and the train set in motion. After the train has been set in motion care must be exercised in advancing the throttle, as there are two conditions that become manifest when attempting to accelerate too rapidly with the Diesel locomotive: First, there is a liability of overloading the generator. Second, severe strain is placed on the draft gear in the head portion of the train. The throttle should not be advanced until the Diesel engines have responded to the throttle setting.

Our committee has admonished against too rapid advancement of the Diesel locomotive throttle when starting a long train, and we repeat with emphasis, all that has been said in this connection; however, when handling the locomotive without cars, or while switching, such as picking-up or setting-out where only a few cars are being handled, more rapid advancement of the throttle is recommended. Under these conditions, two or three seconds is ample time to remain in the different throttle positions.

Not advancing the throttle properly causes delays to important shipments, keeps the locomotive on the road longer and thereby reduces its earning power. It is also reacting very unfavorably for this type of power.

Relation of the Throttle to Brake Applications

When the train brakes are to be used in controlling the train speed, or where a stop is to be made, and the locomotive throttle is then in any position above run (5), the throttle should be placed in run (5) sufficiently in advance of the brake application to permit the locomotive to again develop the maximum power output of run (5) and the train slack to readjust from the reaction of the throttle change before the brake application is started. First service position of the brake valve should be used for the initial reduction after which the brake valve may be placed in lap position. The locomotive brake should not be permitted to apply during the brake application. If the train is to be stopped, the brake application should be started sufficiently in advance of the objective that the initial reduction, plus the leakage, will develop the desired brake cylinder pressure. The locomotive throttle should be reduced as the speed reduces, placing the throttle in idle position and start a final reduction by using regular service position of the brake valve, about forty feet in advance of the stopping point. The locomotive brake should be applied during the final reduction and the rail sanded. Judgment must be exercised in making the final reduction. If made too early the brake application will become effective on the cars near the rear of the train and thereby defeat the object of the final reduction.

If, while making the stop, the engineman finds he has erred in judgment and it is necessary to make the second brake pipe reduction to prevent over-running the objective he should allow twenty to twenty-five seconds time between the closing of the exhaust port from the initial reduction before starting a subsequent reduction. Subsequent reductions should be limited to less than the initial reduction and should not exceed four to five pounds at any time. After the train is at rest the brake-pipe pressure should be reduced to the point where sufficient differential of pressure can be had across the face of the triple or control the valve piston to insure moving the valve to release position before an attempt is made to release the brakes.

Running Releases

Generally speaking, your committee does not recommend making a running release of the brakes on trains consisting of 150 or more cars; however, if the speed, grade, brake application, brake-pipe leakage, and position of slack is favorable, the brakes can, and have been, released on trains of this length without any change or slack. If a running release is desired make the brake application by using first service position of the brake valve for making the initial reduction then move the brake valve to lap position, after which the brake valve may be moved between first service and lap position until the desired brake pipe reduction has been made, which should be from 12 to 15 lb. to insure the release of all the brakes on a long train. As the brake valve is moved to release position the locomotive throttle should be gradually reduced to idle position and the locomotive brakes applied moderately. Release position of the brake valve may be used to advantage in releasing the brakes on long trains. The brake valve can be left in release position fifteen seconds where a fifteen pound brake application has been made without danger of overcharging. After all brakes have released the locomotive brake may be released and when the train has passed over the restricted area the use of power should be gradual to allow for the slack to adjust in case it closed in during the release.

When operating on light descending grades at moderate speeds with long trains and the locomotive operating with the throttle in any position below run (5), and it is desired to reduce the speed to comply with further restrictions, after which a running release is to be made, it is better to advance the throttle to run (5) to assist in stretching the train before the brake application is

started. Initiate the brake application by using first service position of the brake valve then move the brake valve to lap position. After the brake application has been established, while the brake cylinder pressure is low, and before there has been a material reduction in speed, move the brake valve to running position then back to lap, releasing the brakes on a few cars on the head end.

Repeat the movement of the brake valve from lap to running position serially as the speed reduces. To compensate for the loss in retarding force (account some of the head brakes having been released) it will be necessary to increase the brake application either through leakage or by light reductions between the movements of the brake valve to running position. By increasing the retarding force on the rear end of the train and decreasing it on the head end in light graduations allows for the most favorable slack adjustments and will permit a heavier brake pipe reduction thereby creating a higher differential of pressure across the face of the triple and control valve pistons, thus, insuring the release of all brakes. As the brake valve is moved to release position, to complete the release, the locomotive throttle should be gradually reduced to idle position and the locomotive brakes applied moderately.

If, when making a running release, the speed continues to reduce, indicating the brakes are not releasing, additional retarding force should be provided such as is possible by use of the locomotive brake, and if it is evident that train is going to stop, a final reduction should be made about forty feet in advance of the stopping point.

In stopping a long train while backing with Diesel power the same procedure of handling should be followed as if using a steam locomotive, other than the throttle should be placed in idle position as the locomotive comes to rest. Conditions must govern. Ordinarily it is better to use power moderately, make a light brake application keeping the locomotive brakes released and continue to use power until just as the train comes to rest. The stop should be made with one brake pipe reduction. A final reduction should not be made when stopping any train that is being pushed by the locomotive that is controlling the brake operation.

Throttle Handling After Caboose-Valve Brake Applications

With the high capacity feed valve and large volume of main reservoir air pressure on the Diesel locomotive it is more difficult to determine when the brakes are being applied by the use of the caboose valve with the Diesel locomotive than it is with the steam locomotive. And too, the Diesel locomotive develops greater tractive force as the speed reduces, thus requiring a heavier brake application to stall the locomotive; therefore, it is important that the engineman be alert at all times, watch the speed, the power build-up, and reduce the power in ample time and as the speed reduces, place the throttle in idle position and fully apply the locomotive brake about 100 ft. before the train comes to rest. Many knuckle and drawbar failures can be prevented by the proper handling on the part of the engineman during a brake application that has been made by the use of the caboose valve. The automatic brake valve should be left in running position during the brake application.

Should an emergency application of the brakes develop during the time the brake valve is in first service position, the brake valve should be moved to lap position immediately, otherwise, the maintaining valve will be unseated and admit feed-valve air to the brake pipe which will have a tendency to "kick off" the locomotive brake, resulting in a run out of slack and the possibility of a break-in-two. In case of an emergency application of the brakes made independently of the engineman the throttle should be moved to idle position immediately and the brake valve placed in lap position. Experience has proved that it is possible to hold the head portion of the train during an undesired emergency on long trains and thereby avoid break-in-twos.

When the speed control devices function to apply the air brakes, there are certain manual operations necessary, such as moving the automatic brake-valve handle to lap position, which limits the brake-pipe pressure reduction to a full service, or split the reduction by placing the brake-valve handle in first service position. A speed-control application can be suppressed by prompt action when the timing valve whistle blast is heard; this suppression is accomplished by initiating a manual brake application within six seconds following the blast of the whistle. In the event of brake application due to the functioning of the safety control feature device caused by the intentional or unintentional removal of pressure from the foot valve pedal, this application can be limited to a full service reduction, provided the foot valve pedal is pressed to its lowest position, and the automatic brake valve handle is placed in lap position immediately following the start of the application. The fact that these applications can be limited to a full service reduction permits a running release provided the speed is sufficiently high to safely do so.

The Regenerative Brake

Further, in connection with train handling, the freight Diesel locomotive is equipped with an electric regenerative holding brake hereinafter referred to as a dynamic holding brake. The fact that this is a holding brake only, as the name implies, it is, therefore, necessary to assist in slack control and stop a train by the use of the air brakes, which requires the utmost skill.

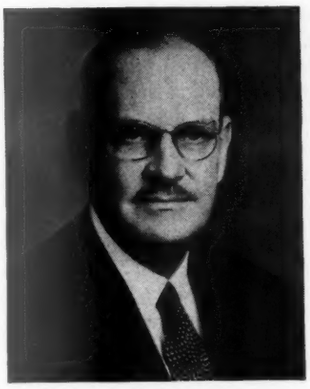
The dynamic holding brake is designed to regulate the speed of a train on a descending grade that is equal in tonnage to a train that the locomotive can haul and successfully negotiate the same grade ascending. When descending a grade with a train consisting of more tonnage operating under conditions mentioned above, on grades where the distance is greater between curves, and in the absence of other easements it is necessary to resort to the use of the air brakes in addition to the dynamic holding brake; in this event the train air brakes are applied with a 10- to 12-lb. reduction and the locomotive air brake is not permitted to apply. Should the train speed reduce to the limits in which the dynamic holding brakes loses its effectiveness, (these speed limits are covered by special instruction), the locomotive air brake must be fully applied in time to compensate for the loss of resistance, due to the dynamic holding brake losing its effectiveness, this to prevent a forward surge of the locomotive at the instant the locomotive is no longer influenced by the regenerative resistance of the dynamic holding brake.

Long trains can be handled just as efficiently and expeditiously with the Diesel locomotive as they can be with the steam locomotive if proper judgment is exercised. Time and intial reductions are very important factors if slack action is to be prevented and controlled. Ample time must be allowed during brake application and the initial reduction limited to not over 5 to 7 lb.

The report was signed by J. B. White, assistant supervisor of air brakes, A .T. & S. F.; P. A. Quarles, assistant supervisor of air brakes, A. T. & S. F.; and E. F. Barsh, assistant supervisor of air brakes, A. T. & S. F.

The "Combustion Train" of the Steam Locomotive

The former Committee on Front Ends, Grates, and Ash Pans adds arches to complete the train of appliances affecting combustion



J. R. Jackson,
Chairman

By reason of the press of regular duties, occasioned by the increasing business resulting from the national emergency, the Committee on Front Ends, Grates, Arches, and Ash Pans has not been able to hold a meeting this year. A list of questions was sent by the chairman to each member on February 3 with the request that replies be sent in on or about May 1 so that there would be as complete and independent an exchange of thought on the subject assigned to the committee as possible.

The returns to the list of questions were very incomplete and did not, therefore, give the cross section of current thought that was anticipated. However, the list of questions circularized and the replies made thereto by the chairman are herewith given with the thought that this material may be of some value in continuing interest among the members in this all-important subject.

[There were 12 questions and answers in the report. The first four are omitted in the following abstract.—EDITOR.]

(5) *Q.—Should, or should not, locomotives using different grades of fuels be drafted for best all-around fuel economy, free steaming and minimum on-line and terminal attention to the essential appurtenances involved (front-end, flues, arch, grates, pans)?*

A.—Yes. There has to be a certain degree of flexibility or adjustability to the combustion train in a steam locomotive to permit of "drafting" for the character or preparation of the fuel available; there is no such thing as a standardized combustion train (front-end, flues, grate, arch, pan) to make a locomotive universally available to burn economically all grades of fuel—even solid fuels on grates.

(6) *Q.—As applying to the commonly used term "drafting a steam locomotive." (a) Give your definition. (b) What factors are involved? (c) How accomplished to give best results?*

A.—The term "drafting a steam locomotive," in the broad sense, is the adjustment of the combustion train (front end, grates, arch, pan) to regulate the flow of air through the fire-bed to effect combustion and to direct the flow of the heated gases from above the fire, through the firebox and flues, to convert the heat energy liberated through the combustion process into steam. This is accomplished through the regulation of the volumetric flow of the gases by controlling resistances in the paths of flow. "Drafting" also usually includes control of the fire hazard and provision of a self-cleaning front end.

A locomotive has certain "fixed resistances" built into it which cannot be changed in the ordinary process of drafting the locomotive. These are size and setting of stack, height of nozzle stand, front-end dead plates and netting, flues and tubes, firebox, grate area and air opening, pan air opening. There are other "adjustable resistances," the principal ones being front-end plates and arch setting. Other things remaining the same, "draft" is proportional to nozzle-tip area, consequently:

(a) A locomotive is usually drafted by adjusting the size of the exhaust-nozzle tip to provide adequate draft for burning the grade of fuel supplied.

(b) Adjustment of nozzle area, draft plate and arch setting are about all that can ordinarily be done to "draft a steam locomotive" by shop and road forces.

(c) Drafting a steam locomotive in the larger sense should start at the drawing board when the locomotive is designed, the designer giving consideration to the best proportion and arrangement of the essential parts of the entire combustion train (front-end, flues, arch, firebox, grates and pan).

(7) *Q.—What size or grading of bituminous coal is best adapted to all-around locomotive use? Is there any limit as to sizes, particularly smaller sizes or "fines" which can be economically burned on grates? If so, what are these limits?*

A.—With locomotives drafted for a 2-in. screening preparation, this grade of bituminous coal from a given source is the best for all-around locomotive use. The limit to the smaller sizes of coal which can be economically burned on grates is the natural impurities in the small sized available coal or their preparation by washing, etc. to reduce the impurities in the small sizes. So long as it is coal and not *dirt*, small sized coals can be economically burned on grates as long as the drafting of the locomotive to burn the smaller sizes includes the grates and arch as well as the front-end.

(8) *Q.—How should a locomotive be drafted to small size bituminous coal on grates most economically burn?*

A.—Ample areas of stack and nozzle, restricted air-opening and properly fitted grates and a sealed arch.

(9) *Q.—Are you familiar with the "Master Mechanics' Locomotive Front-End Arrangement" and with the data and design instructions relating thereto as shown in Section F of the A.A.R. Manual, Pages F-211 to 231-1937? To what extent are these design data being used on the railroad with which you are connected.*

A.—The A.A.R. front-end design details and formulæ are not followed to any extent on the Missouri Pacific.

(10) *Q.—Are you familiar with the University of Illinois studies of the locomotive front-end by means of tests on a front-end model, Bulletin No. 256 (May, 1933) and Supplement No. 274 (May, 1935), also Fuel Association Annual Report 1933? To what extent has the information made available by research been used on the railroad with which you are connected?*

A.—The basic information contained in U. of I. studies has not been given the consideration it should by the railroads. This is true of the Missouri Pacific. We are now arranging to apply an experimental front-end arrangement patterned largely after the U. of I. general recommendations and hope to develop worth-while information when circumstances permit.

(11) *Q.—What devices, design changes, or practices having to do with the combustion of fuel, which have come into general practice during the past ten years, have resulted in the greatest improvement in the overall cost of evaporating water into steam (a) for coal-burning locomotives and (b) for oil-burning locomotives?*

A.—There were three answers to this question. The chairman and W. E. Small, B. & M., cited restricted air openings in the grates and closer attention to the fitting up and maintenance of grates. H. E. Green, Nor. Pac., listed the following appliances: brick arches, superheaters, feedwater heaters, exhaust-steam injectors, Thermic syphons, air-operating fire doors, flue blowers, circulators, and feedwater treatment. Applying specifically to (b) the chairman cited heating facilities for handling and firing the heavier grades of residuums.

(12) *Q.—Where lies the greatest possibility for further improvement in the economical burning of fuel in the steam locomotive which may be released during the next decade through improvement in functioning or maintenance of any of the component parts or better correlation of appurtenances covered by the committee (a) for coal-burning locomotives and (b) for oil-burning locomotives?*

A.—Four members of the committee commented on the subject of this question. Three (J. R. Jackson, Mo. Pac.; H. E. Green, Nor. Pac.; and W. E. Small, B. & M.) gave correlation of the essential parts of the combustion train as the answer; two (Messrs. Jackson and Small) referred specifically to the possibilities of the development of nettingless front ends; the third (Mr. Green) added improvements in the steam-distribution system and treatment of boiler feedwater. The fourth member of the committee (E. G. Young, University of Illinois) believed that "the ultimate in locomotive fuel economy will be obtained when a CO_2 recorder can be installed as one of the back-head instruments, accompanied by a by-pass to exhaust some of the steam directly to the open air, with enginemen trained to adjust the flow through that by-pass in order to get the largest amount of CO_2 in the flue gases."

The report was signed by J. R. Jackson (chairman), engineer of tests, Mo. Pac., St. Louis, Mo.; B. C. Bertram, railroad salvage director, Bureau of Industrial Conservation, WPB, Washington, D. C.; H. E. Green, fuel supervisor, Nor. Pac., St. Paul, Minn.; H. L. Malette, road foreman equipment, St. L.-S.F., Springfield, Mo.; W. E. Small, chief fuel supervisor, B. & M., Boston, Mass.; S. R. Tilbury, fuel supervisor, A. T. & S. F., Topeka, Kans.; L. W. Withrow, M. A. O. inspector, C. & O., Clifton Forge, Va.; and E. G. Young, University of Illinois, Urbana, Ill.

Firing Practice on Coal-Burning Locomotives

Get the fire started right, then watch it closely—The stoker will do only what the fireman makes it do

W. C. Shove,
Chairman

On stoker-fired engines with interior of cab design which will permit the use of shovel, it is suggested building up fires at initial starting points, and firing of locomotive around yard before trip is started, be done with the shovel because in a number of cases small banks and clinkers were started at terminals which later caused trouble on the road. This practice is recommended at starting points only where a new green fire is involved because after the fire has a bright bed and the brick arch is warmed up, there does not seem to be nearly as much liability of doing damage to the fire as there is before.

In a number of cases bad fires are started leaving terminals by crowding the fire before the arch is heated to a point where perfect combustion will take place. As a possible remedy for this it is recommended that where boiler and water conditions permit, an effort be made to start on the run with enough water in the boiler to permit the loss of drop in boiler water for a few minutes or a few miles, until the arch has heated up, and thus relieve the inclination on the part of the fireman to crowd the firebox with coal when it is not being properly burned in an effort to maintain maximum steam pressure.

Whatever water level is carried, it should be maintained with an even, steady flow, refraining from flooding the boiler at one time and shutting off at another. This will prevent damage to boiler and firebox sheets by rapidly changing temperature and the waste of fuel that is ever apparent with improper handling of the feedwater supply to the boiler.

The Stoker No Substitute for a Fireman

After the train is out of the terminal and well under way, the fire should be watched closely and, if necessary, the stoker should be stopped as sometimes it is very difficult to see fire with stoker in operation. Firemen should never be allowed to think other than that the mechanical stoker is only a machine that was designed to place an even layer of fuel over the fire bed, and will only do what we make it do. The stoker does not know what portion of the firebox is using the greatest amount of fuel, neither does it know where a bank has been started, and it is always necessary for a fireman to keep almost constant watch of the fire at all times.

Firemen should be instructed to watch the steam pressure necessary to run the stoker at an even speed that will just supply the need for fuel and avoid the continual racing and shutting off of stokers, which usually

results in heavy banked fires and excessive smoking.

Firemen should watch the smoke stack. Considerable good information is obtained by noting the color of smoke or exhaust coming from the stack. Where it is possible to maintain steam pressure with a perfectly clear stack, it is in line with good handling occasionally to make several quick turns of the stoker, and if stack can be momentarily clouded it is a good indication that the jets are properly set and that the stoker is distributing an even supply of fuel over the entire grate area.

In some cases where fires were banked, possibly by poor handling of stoker, the fireman shakes the entire bank into the ash pan, which results in waste of fuel and delay while dumping ash pans.

The proper shaking of grates is an important factor in connection with good firing practice. Grates should be shaken often enough to keep dead ashes off the grates when the fire becomes so heavy that it restricts the free flow of air to the firebox. No standard can be set up that will apply to all roads under all conditions as to how often and how hard grates should be shaken. This will depend on the quality of coal, the type of grates and the quantity of coal fired in a given period.

Firing locomotives on drifting movements requires considerable good judgment and experience to maintain steam pressure and avoid trailing black smoke, especially in cases where drifting throttles are used to excess or where too much steam is admitted to the cylinders. On drifting movements, when operating and engine conditions permit, side sheets should be fired alternately and no fuel placed over the entire grate area at the same time.

On free steaming stoker fired engines it is the tendency of some enginemen to work the engine at too long a cut-off, with little regard for the amount of back pressure used and the harmful, wasteful results. A partial remedy for this bad practice is to equip large locomotives with a back-pressure gauge, with instructions issued as to the maximum amount of back pressure permitted on the different classes of engines.

Don't Abuse the Blower

To furnish steam for the locomotive blower at full capacity, consumes fuel at the rate of approximately 600 lb. of coal per hour. This will serve to indicate the extent of waste possible through abuse of the blower. In the interest of economy, do not apply the blower except when necessary and then as lightly as conditions require.

Good team work among all departments and classes of employes on a railroad is always very essential to successful operation and one of the most important places where good team work will have the desired effect is on the locomotive. Its appurtenances function properly only when they are all handled correctly by the engineer and fireman working together.

The report was signed by W. C. Shove, chairman, general road foreman of engines, N. Y., N. H. & H.

Firing Practice on Oil-Burning Locomotives

This report emphasizes that the economy attained in fuel consumption depends largely on the performance of the engineman

R. W. Hunt,
Chairman

Previous reports of the committee have covered the duties of a fireman from the time he got on the locomotive to start the trip until he was at the end of the run.

Too little attention has been given to water supply or pumping the boiler, and it is assumed on greater number of roads that this is the fireman's duty. Larger power with boilers of greater capacity and higher pressures have made necessary a near approach to the use of the water feeding appliance at the rate steam is taken from the boiler. This, if practiced, gives most economical conditions as to feed-water temperatures, uniform water level, higher super-heat temperatures, and reduced strains on various stressed portions.

The Engineman's Part in Firing Practice

In bad water territory, the fireman will watch you if you blow out a little water and he will perhaps do the same. This procedure with the blow-off cocks before starting and a little understanding how you will work the injectors or water pump and the water level, will give you a good start. A fireman familiar with your ways of operation and the grades on the division will need no coaching.

Though the engineman is working the engine to what he thinks is capacity he may find that the water level is getting lower. Naturally, he will question if pump is on full open and lubricated, or injector wide open. This should suggest to him he has gone beyond the economical point with the reverse lever. It is assumed that the left side water supply appliance is of capacity adequate to develop the maximum boiler horsepower. Very few realize or recognize the fact that the second water supply unit is a reserve in event of a failure of either one. If the engineman would recognize this as much as he does the sound of the exhaust, he would do much in cooperating with the fireman.

The right side can do a lot by giving the fireman a warning in advance of his moves. Even if the fireman knows the next stop or change in the grade, different enginemen shut off at different places to stop at the same water column. If everyone is prepared to make moves in advance, they can do better.

Then, at the end of the trip when the engine is turned over to others, a word of praise or a compliment on things that were done properly. If something was done wrong, just say that next time we will try doing this

or that in some different way. An interest in the fireman's efforts to keep full steam pressure with a clear stack and ample supply of water in boiler will assure a better trip over the road next time.

The foregoing is the first observation of an engineer on an oil-burning locomotive. Under ordinary operation his urge is to get the train under way as rapidly as possible. He may not realize that the cylinders and boilers are comparative low in temperature, and water in the boiler heated only in spots and above all that there is approximately 2,700 lb. of brick in the fire box which has to be heated to 2,000 to 3,000 deg. F. before the steaming performance of the engine actually becomes efficient.

The report was signed by Roy W. Hunt (chairman), fuel supervisor, A. T. & S. F.

Can More Locomotive Hours Be Made Serviceable?

Pertinent question to which managements should seek answers—Expediting engines through terminals stressed

A. A. Raymond, Chairman

The Committee on Utilization of Locomotives has given careful study to determine opportunities for increasing the use of locomotives. It suggests that consideration be given to preparing for handling considerably more business, and for handling the present or increased business with the most effective use of man power. It should be determined whether an analysis of present locomotive performance indicates that there is more serviceable time available for road work. More intensive use, if possible, would permit concentration of available man power and tend to reduce temporary repair types of work, besides permitting the handling of a considerable increase in business or of handling the same business with fewer locomotives. It should also be determined whether definite supervision of the use of locomotives will not pay in present or future shortages of locomotive parts and labor.

What Is Needed? Can It Be Obtained?

Prudent management is giving very careful thought to what will be necessary if, say, 25 per cent more trains are presented for handling or if a shortage of critical material makes it necessary to increase locomotive utilization 25 per cent and, with the impending labor shortage, to what can be done to utilize available labor and facilities to the greatest extent.

All roads can obtain the figures for the performance of their locomotives, that is, the average miles per day of active locomotives (all those not held at enginehouses or shops out of service for a calendar day for repairs); the per cent out of service at both shops and enginehouses will show the efficiency with which repairs are made. The Railway Age of July 4, 1942,[1] and one's general experience will indicate what is a good figure.

Having the miles per day, a close estimate can be made of the hours per day these active locomotives are working. Such a study was noted in the *Railway Mechanical Engineer*[2] where one road found engines on the road about eight hours out of every 24 and yard engines working about 11 hours out of every 24. The same thing can also be approximated from the average speed of passenger and freight trains and the established ratio of six miles per hour for yard locomotives.

A further detail study can then be made at each terminal jointly by the operating and mechanical officers who, studying each locomotive sent to the enginehouse, will answer the question "Why is it necessary to take the locomotive out of revenue service and send it to the enginehouse?" The answer may be that there is no work available for the locomotive at the particular time it arrives at the terminal; considerable ingenuity is frequently required to keep locomotives working, perhaps on connecting jobs.

Other reasons may be that the locomotive requires supplies, water, coal, fire cleaning, or periodical repairs. Taking on water and coal, and cleaning the fire might, with suitable equipment, be performed close to where the locomotive is relieved. There is considerable experience to indicate that the three jobs can be performed in about 20 min. If the need of running repairs is the reason, perhaps this work can be done at the same place. It may be possible, by concentrating a group of capable men at a point near where the locomotive is relieved, that they can handle the running repairs expeditiously and thus free the other mechanics for steady work on reconditioning jobs, each with all necessary facilities to reduce the "Walking time" and "poor tools" time to a minimum.[3]

What Some Locomotives Are Doing Others Can Do

So many road engines are working many continuous hours daily that it would seem possible to say that the machine itself is capable of providing greater service. Many yard locomotives are also working approximately two-thirds of the day.

A committee report of the American Association of Railroad Superintendents at the last meeting in Chicago

[1] See "Greater Use From Locomotives," July 4, 1942, Railway Age, page 24.
[2] See editorial "How High Is Your Score?", August, 1942, *Railway Mechanical Engineer*, page 344.
[3] See "Walking Time Can Be Reduced," April, 1942, *Railway Mechanical Engineer*, page 168.

pointed out that when running locomotives through terminals careful consideration should be given to the arrangement of tracks, fueling, watering and other service facilities to promote expeditious handling; that where operating conditions justify, runs of locomotives should be extended to increase their productive time; that special attention should be given to the possibility of reducing the running time of locomotives at terminals; that operating and mechanical officers should collaborate in closing the gap between actual and potential locomotive service.[4]

The report was signed by A. A. Raymond (chairman), superintendent fuel and locomotive performance, New York Central, Buffalo, N. Y.

Coal Equivalent of Other Fuels and Power

Attention is called to the effects of the widely varying values of equivalents on coal consumption reported

E. E. Ramey,
Chairman

In the introduction of its report the committee calls attention to the action of the association during the 1941 convention of the association when the officers and members of the Executive Committee were directed by vote from the floor to take steps to obtain, if possible, the publication of more detailed fuel statistical reports for the Class I railways than were then available for general distribution. The committee recites the action taken in bringing the matter to the attention of Dr. Julius H. Parmalee, director, Bureau of Railway Economics, A.A.R., who agreed to prepare a comparative statement of unit power and fuel consumption of locomotives by individual railroads when the final statistics for the year 1941 became available. The committee recorded the issuing of the report by the Bureau of Railway Economics on February 17, 1942, and of its subsequent publication in the Railway Age of April 18, 1942.

Coal Equivalent of Fuel Oil

The discussion of previous reports of this committee dealing with coal equivalents at present used for equating the various kinds of fuel and power have centered particularly around the question of the coal equivalents used by different roads for equating the fuel oil used in oil burning steam locomotives. It seems probable that this preponderance of interest has been based upon the fact that on 18 roads in the Western District the fuel oil used in oil burning steam locomotives ranges in amount (1941) from 2.3 per cent to 100 per cent with an average of 43.7 per cent of the total fuel reported in freight service on those roads, and the correspondingly important effect upon the unit fuel performance reported by these roads that is exercised by the equivalent values used in equating the oil to coal.

The exhibit shown in Table I sets forth some of the significant aspects of this feature as reported by these roads for the year 1941. The eighteen roads have been listed in two groups. For the eight roads included in Group I the equivalent values which are used in equating fuel oil to coal, gallons per ton, vary from 126 to 162 and average 140. The ten roads in Group II all use an equivalent value, in equating fuel oil to coal, of 168 gallons per ton.

The percentage of the gross ton mileage of each road that is made with oil-burning locomotives, Col. 1, is shown to vary from 2.7 to 75.3 with an average of 27.8 per cent for the Group I roads, while this item varies from 40.8 to 100.0 with an average of 81.4 per cent for the Group II roads.

Section 1 of the table shows for each road, and for the averages of the groups, how the equivalent coal consumption in pounds per 1,000 gross ton-miles works out for the oil-burning locomotives, Col. 5, the coal-burning locomotives, Col. 6 and all the locomotives, Col. 7, based upon the equivalent values actually used by each road in equating fuel oil to coal, Col. 3. The average oil consumption of the Group I roads in gallons per 1,000 gross ton-miles, Col. 2, is only 3.5 per cent greater than that of the Group II roads, but the averages of the equating values used makes the "pounds of coal per gallon of oil," (Col. 4) 20.2 per cent higher for the Group I roads with the result that the average "pounds of equivalent coal per 1,000 gross ton-miles" for oil-burning locomotives (Col. 5) on the Group I roads is 24.2 per cent higher than on the Group II roads.

Section 2, of Table II shows how these items would work out for each of the eighteen roads listed if each road should use the equivalent value for equating fuel oil to coal, 140 gals. per ton that is shown to be the arithmetical average of the values actually used by the Group I roads for this item (Cols. 3-4-8-9). It will be noted that under this assumption the values "for pounds of equivalent coal per 1,000 gross ton-miles" with oil-burning locomotives, (Col. 11) for each of the eighteen roads is different from that shown in Col. 5, the unit coal consumption of the coal-burning locomotives is of course unchanged (Cols. 6 and 11), the values for, "pounds of equivalent coal per 1,000 gross ton-miles" for all locomotives (Col. 12) is slightly different for all except one of the Group I roads and is from 9 per cent to 20 per cent higher for each of the roads in Group II. While the averages for the Group I roads remain unchanged since this is the base for the recalculation, the averages for the Group II roads, except for Col. 6 and 11, are from 16 to 20 per cent higher in Section 2 than in Section 1 of the table, due to the effect of the differ-

[4] See Railway Age, July 4, 1942, page 25.

ence in the equivalent value used for equating oil to coal which results in an average difference of 20 per cent in the weight of coal recorded per gallon of oil consumed.

Coal Equivalent of Electric Power

Because of the fact that there is such wide variation in the equivalent values for equating electric power to coal used by the six railroads on which electrical operation is sufficiently important to exert an appreciable effect upon the performance records in road freight service, we have prepared Table II to set forth some interesting comparisons.

The six roads have been listed in two groups. The three roads included in Group I use equivalent values in equating electric power to coal which vary from 350 to 684 kw. hrs. per ton of coal and average 470. The three roads listed in Group II use equating values which vary from 1,094 to 1,363 and average 1,265 kw. hrs. per ton of coal.

The percentage of the gross ton mileage of each road that is made with electric locomotives, Col. 1, is shown to vary from 1.4 to 8.7 with an average of 4.3 per cent for the Group I roads, while this item varies from 14.1 to 33.4 with an average of 15.5 per cent for the Group II roads. From this it follows, of course, that the choice of equivalent values for equating electric power to coal exercises a much more important influence on the final values of the fuel units reported for the Group II roads than for the Group I roads, which is clearly shown by the comparison of Columns 7 and 12.

The electric power consumed, kw. hrs. per 1,000 gross ton-miles, Col. 2, by the Group I roads averages 41.00, and by the Group II roads averages 23.80 being 72.3 per cent greater on the Group I roads where the electrified lines are principally on heavy mountain grades.

The equivalent value used for equating electric power to coal, stated as pounds of coal per kw. hr., Col. 4, by the Group I roads averages 4.25 which is 169 per cent greater than the average value of 1.58 used by the Group II roads. It is obvious that this very great difference in the equating values is principally responsible for the fact that the Group I roads report an average of 174 lbs. of equivalent coal per 1,000 gross ton-miles, made with electric locomotive, Col. 5, which is 370 per cent higher than the average of only 37 lbs. reported by the Group II roads.

Section two of Table II has been compiled in the same manner as was Section two of Table I, based upon applying to the calculation for each road the arithmetical average of the equivalent values used by the Group I

Table I—Freight Service 1941 (Gross Ton-Miles, including Locomotive and Tender)

			SECTION 1					SECTION 2				
			Equating value used, oil to coal		Equivalent coal, lb. per 1000 g. t. m.			Avg. equating value		Equivalent lb. coal per 1000 g. t. m.		
Road	Per cent of g. t. m. with oil-burning locos.	Oil consumption gals. per 1000 g. t. m.	Gals. per ton	Lb. coal per gal.	Oil-burning locos.	Coal-burning locos.	All locos.	Gals. per ton	Lb. per gal.	Oil-burning locos.	Coal-burning locos.	All locos.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Group I:												
Nor. Pac.	2.7	6.65	126	15.9	106	125	124	140	14.3	95	125	124
Gt. Nor.	47.5	6.47	127	15.7	102	91	96	140	14.3	92	91	92
C. M. St. P. & P.	4.6	9.03	128	15.6	141	109	115	140	14.3	129	109	114
C. B. & Q.	5.3	8.09	130	15.4	124	106	108	140	14.3	115	106	107
A. T. & S. F.	75.3	8.21	138	14.5	119	108	116	140	14.3	117	108	115
Un. Pac.	19.7	10.85	147	13.6	147	118	124	140	14.3	155	118	125
C. & N. W.	7.0	9.67	157	12.7	123	117	118	140	14.3	138	117	119
Mo. Pac.	13.7	7.54	162	12.3	93	117	113	140	14.3	108	117	115
Averages	27.8	8.28	140	14.3	118	113	115	140	14.3	118	113	115
Group II:												
Westn. Pac.	73.5	7.71	168	11.9	92	109	96	140	14.3	110	109	110
K. C. Sou.	69.0	8.68	168	11.9	103	135	113	140	14.3	124	135	127
M. K. & T.	99.8	7.09	168	11.9	84	274	85	140	14.3	101	274	102
Frisco	40.8	9.06	168	11.9	108	129	121	140	14.3	130	129	130
St. L.-S. W.	97.9	6.76	168	11.9	81	195	83	140	14.3	97	195	98
I. G. N.	100.0	9.08	168	11.9	108	—	108	140	14.3	130	—	130
T. & N. O.	100.0	7.15	168	11.9	85	—	85	140	14.3	102	—	102
T. & P.	100.0	7.10	168	11.9	85	—	85	140	14.3	102	—	102
C. R. I. & P.	54.3	8.11	168	11.9	97	124	110	140	14.3	116	124	120
Sou. Pac.	93.3	8.39	168	11.9	100	107	100	140	14.3	120	107	119
Averages	81.4	8.00	168	11.9	95	122	100	140	14.3	115	122	116
Averages of Groups I and II	45.9	8.12	155	12.9	105	115	110	140	14.3	116	115	115

Table II—Freight Service 1941 (Gross Ton-Miles Including Locomotive and Tender)

			SECTION 1					SECTION 2				
			Equiv. val. used electric to coal		Equivalent coal in lb. per 1000 g. t. m.			Avg. equivalent value		Equivalent lb. coal per 1000 g. t. m.		
Road	Per cent g. t. m. with electric locos.	Electric power consumed—kw. hrs. per 1000 g. t. m.	Kw. hrs. per ton	Lb. coal per kw. hr.	Elec. locos.	Steam locos.	All locos.	Kw. hrs. per ton	Lb. coal per kw. hr.	Elec. locos.	Steam locos.	All locos.
			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Group I:												
Gt. Nor.	1.4	32.22	350	5.72	184	91	96	470	4.25	137	91	96
C. M. St. P. & P.	8.7	30.19	380	5.26	159	109	115	470	4.25	128	109	112
N. & W.	2.5	84.46	684	2.92	246	83	87	470	4.25	338	83	91
Averages	4.3	41.00	470	4.25	174	96	100	470	4.25	174	96	100
Group II:												
Virginian	33.4	37.96	1,094	1.83	69	106	94	470	4.25	162	106	125
Penna.	14.1	21.49	1,333	1.50	32	124	112	470	4.25	91	124	120
N. Y. N. H. & H.	19.2	25.31	1,363	1.47	37	118	103	470	4.25	108	118	116
Averages	15.5	23.80	1,265	1.58	37	123	110	470	4.25	101	123	120
Averages of total Groups I and II	10.8	26.62	870	2.30	60	111	106	470	4.25	113	111	111

roads, i.e., 470 kw. hrs. per ton of coal or 4.25 lbs. of coal per kw. hr. When calculated in this manner the effects of differences in the equivalent values used for equating electric power to coal on the different roads are eliminated from the computation and the effects of the differences in the actual unit consumption of electric power, in kw. hrs. per 1,000 gross ton-miles, alone appears. This produces an average for the Group II roads of 101 lbs. of equivalent coal per 1,000 gross ton miles made with electric locomotives, Column 10, instead of the average of 37 which was actually reported, Column 5.

Followed through to the final unit, equivalent pounds of coal per 1,000 gross ton-miles made by all locomotives, Col. 12, the average for the Group II roads becomes 120 instead of the 110, Col. 7, which was actually reported and of course the unit for each individual road in the group is correspondingly raised as shown by the comparison of Columns 7 and 12.

The committee believes that the demonstration afforded by these exhibits offers ample evidence of the important effect upon the fuel performance finally reported that is exercised by the mere choice of the equivalent values used in equating the several forms of fuel and power to coal. Unquestionably accounting officers are interested in the accurate reflection in the reports of the performances that are actually being made with the fuels and power consumed on their respective roads. We direct their attention to the apparent inconsistencies of the present situation with respect to the figures in these reports.

We advocate a basis of equivalence with which we have found no disagreement in principle: A consistent equating value for any form of fuel or power is one that will produce a fuel unit, in pounds of equivalent coal per service unit, of the same order of value as that produced on the same territory by coal burning locomotives in the same kind of service, and therefore the conversion factor or equating value used should be such that a road using electricity, fuel oil, gasoline or Diesel fuel could at any time return to the use of coal without affecting the values of the fuel performance units on the territory in question.

The report was signed by E. E. Ramey (chairman), fuel engineer, B. & O., Baltimore, Md.; P. E. Buettell, fuel supervisor, C. M., St. P. & P., Chicago; J. G. Crawford, fuel engineer, C. B. & Q., Chicago; J. R. Jackson, engineer of tests, Mo. Pac., St. Louis, Mo.; H. Morris, superintendent fuel and locomotive performance, C. of N. J., Jersey City, N. J.; E. G. Sanders, fuel conservation engineer, A. T. & S. F., Topeka, Kans.; W. R. Sugg,* superintendent fuel conservation and lubrication Mo. Pac., St. Louis, Mo.; W. J. Tapp, supervisor fuel conservation, D. & R. G. W., Denver, Colo.; R. J. Tucker, assistant to fuel supervisor, C. & O., Richmond, Va.; and R. S. Twogood, fuel engineer, Sou. Pac., San Francisco, Calif.

The Relation of Coal Sizes to Fuel Economy

The committee recommends cleaned sized coal 2 in. to 2½ in. by 0 in. for stoker-fired locomotives and 4-in. mine run for hand-fired locomotives

S. A. Dickson,
Chairman

This year your committee on Coal—Various Sizes in Relation to Fuel Economy, realizes the importance of continuing and advancing our 1941 report under the heading, "Coal-utilization of the various sizes." That report showed that the smaller sizes of coal can under certain conditions be used to advantage.

In the present report we will endeavor to show the relative values of various sizes as a steam locomotive fuel. It will be noted that this subject makes no reference to chemical analyses, the price delivered, or the manner in which it is fired, i. e., mechanically or by hand. But as it can not be assumed that the coal which shows the best performance on a thousand gross ton mile basis would be the most economical on a cost basis, we should set opposite the 1,000 gross ton-mile figures the money value. If that is done, what follows will apply with equal force to the different grades of coal (British thermal units value) used on the various railroads.

In considering the use of smaller size coal it is very important that the cost per ton from the various mines be reduced to a B.t.u. basis. Other factors being equal, the coal with higher heat content would be the most economical to use.

On all coals available for locomotive use a complete analysis of each size of coal should be made for each mine. In some instances the nut or egg size of coal will show better by analysis than the lump or smaller sizes below the nut size. In other instances the smaller sizes of coal will show better than the nut, egg or lump.

Preparation of coal is of utmost importance, particularly when considering the use of the smaller sizes on locomotives. In mining operations coal naturally is broken down to a certain extent, which produces screenings and such screenings naturally will contain a great deal of fines and impurities such as fire-clay, bone, rock, etc. It is difficult to remove such impurities from the smaller sizes of coal by hand picking. Such coal is not satisfactory for locomotive use if the percentage of screenings exceeds 35 to 40 per cent of the total coal. Where coal companies are equipped with mechanical cleaning plants, they mechanically clean all coal that will pass through a 2-in. round-hole screen. Such coal

* Mr. Sugg is now general supervisor of air brakes at St. Louis, Mo.

makes an excellent locomotive fuel, particularly for mechanically fired locomotives. This same coal might be very inferior for locomotive use if not mechanically cleaned.

The design of the locomotive boiler and fire-box is an important factor when considering the use of the smaller sizes of coal. They can be more economically burned in locomotives that have large fire-box volumes which are provided with combustion chambers. A large fire-box volume with a combustion chamber will permit the smaller sizes of coal to be more thoroughly burned before they enter the flues.

Locomotives that have large grate areas can use the smaller sizes of coal more economically than locomotives with small grate area. The openings through the grates should be small and designed to avoid direct fuel-bed bombardment if possible. But enough total area should be provided to admit sufficient air for complete combustion of the coal. Grates with large air openings are undesirable for the reason that the small sizes of coal will fall through.

Generally it is not found economical to use the smaller sizes of coal on hand fired locomotives. On the other hand, where well prepared coal contains as much as 65 per cent screenings, and can be obtained at a differential in price, sufficient to justify its use on mechanically fired locomotives, the smaller sizes of coal when properly prepared and mechanically cleaned will contain more British thermal units per pound than the egg or nut coal. This produces further fuel economy due to the higher heat content. The use of hand fired locomotives will, of course, become less each year due to the increase of mechanically fired locomotives.

On territories where both hand and mechanically fired locomotives are operated, coal chutes with separate bins for hand and mechanically fired coals are almost a necessity.

It is most desirable when calculating the locomotive fuel performance on a 1,000 gross ton-mile passenger car mile and switch locomotive hour basis to have a coal containing as small a percentage of ash and moisture content as is consistent to obtain. Any reduction that can be made of this non-combustible substance in the coal will increase the B.t.u. content per pound of fuel as fired. The best known method found to date for reducing to a minimum this non-combustible material in the raw coal is by mechanical cleaning.

The tests covered in the University of Illinois' Bulletin No. 101 show that run-of-mine coal is the most economical fuel for hand firing operations. This test was made on a stationary test plant. Therefore the results could not be set up on a 1,000-gross-ton-mile basis. Nevertheless, the data is so comprehensive that it can logically be assumed that on a 1,000-gross-ton-mile basis, run-of-mine coal would still occupy the same position in relation to lump, egg and 2-in. screenings. The 1¼-in. screenings tested were mechanically fired and therefore are eliminated in the present analysis. In fact, as these tests have since been confirmed in road tests, we can safely accept them as conclusive and on that basis recommend the use of run-of-mine coal for all hand-fired locomotives.

The University of Illinois test data show clearly why run-of-mine coal, hand fired, gave a better all-round performance based on continuous operation, but, as in general locomotive operation and particularly in yard service, the demand on the boiler changes almost instantly from full load to no load and vice versa it is necessary to carry a fire of sufficient depth to meet instant maximum demand. This practice is not economical.

A booklet was issued by the United States Railroad Administration during the last war titled, "Economical Use of Locomotive Fuel." As this booklet may no longer be generally available, we will give a brief synopsis of a test and the results. The test was conducted in regular road service, the purpose of which was to determine, if possible, first, the drop in fire-box temperature when the fire-door was held open continuously while two scoops of coal were being fired and, second, to determine the drop in temperature when the fire-door was held open continuously while eight scoops of coal were being fired and then kept closed until another firing was required.

As it was impractical to take direct fire temperatures with the equipment at hand, superheat temperatures were used as indicated by the pyrometer. When but two scoops were fired, the average superheater temperature drop was 10 deg. When eight scoops were fired, the average superheat temperature drop was 30 deg. This denotes the advisability of keeping the fire-door closed as much as possible.

It is easier to abate objectionable smoke when maintaining a bright fire by keeping the fire-door closed and using the blower. When the fire is green and dark red in color, the fire-door will have to be opened and the blower valve opened to abate the smoke nuisance.

The air passing through the fuel bed controls the rate of combustion. The air passing over the fire controls the efficiency of combustion. It requires about 11½ lb. of air by weight, or 150 cu. ft. by volume, to supply enough oxygen to burn one pound of average bituminous coal, and about half as much for lignite. But as some excess air is needed, we can use as our factor about 15 per cent more.

The velocity of inflow is proportional to the difference in pressure above and below the fuel-bed and will average from 50 to 150 ft. per sec. depending on the rate of combustion, regardless of the amount of air opening through the grates.

If the air openings through the ash pan are not sufficient to maintain atmospheric pressure below the fuel-bed at all rates, it follows that the pressure above the fuel-bed in the firebox will be decreased correspondingly. This means a higher draft and usually a smaller nozzle.

During a test in 1926 some observations were made through 2-in. openings piercing the sides of the firebox. It was noted that over certain parts of the fuel-bed relatively large pieces of coal were apparently caught by the draft currents passing through the fire, and lifted into the zone of high gas velocity. From there they were carried over the arch and eventually out the stack, while at other points equivalent pieces were only lifted a short distance and fell back on the fuel-bed to be totally consumed.

Investigation indicated that some of the grate bars (finger type) had moved laterally, thereby increasing the air openings at some points and restricting them at others. This difference in areas correspond with the difference in a lifting effect of the vertical air jets, as a readjustment of the grates apparently equalized the lifting action. On these observations was based the theory that the lifting action of the vertical air jets is proportionate to the square of their area. If these areas were reduced so that the smaller particles of coal would not be projected into the high velocity gas streams cinder discharge would be correspondingly reduced. The correctness of this theory is well supported by the New York Central Selkirk tests, where moving pictures were obtained showing for the first time in the history of the steam locomotive the actual behavior of the fire-bed under various rates of combustion.

Small sized coal, properly cleaned, can be economically

burned in a mechanically fired steam locomotive without appreciable stack loss or cinder cutting, providing the necessary affecting details are adapted to that purpose. These details, in the order of their importance, are as follows:

1. A dumping locomotive grate so designed as to permit the necessary inflow of air to support combustion and at the same time eliminate vertical air jets.
2. Plenty of air opening into the ashpan with pan flares extending slightly above the bottom level of the mud-ring. The clearance between ashpan and mud-ring should be at least 18 per cent of the total grate area.
3. A brick arch sealed at the throat sheet, the area of the opening between the back of the arch and the crown sheet to be not less than 120 per cent of the net gas area of all the tubes and flues.
4. Reduce to a minimum all obstructions in the front end tending to restrict the free flow of gas to the stack.
5. An exhaust nozzle as large as possible, consistent with good steaming with the lowest grade of coal used. The lowest grade of coal which is to be used is the number one factor that must be taken into consideration when considering the proper drafting of a locomotive.
6. The greatest possible combustion-chamber volume.
7. An effective locomotive blower, properly used which includes the proper co-ordination of the blower-valve adjustment with that of the main throttle-valve operation.

We recommend run-of-mine, with the lumps larger than 4 in. top size to be reduced to that size as most economical for all hand-fired locomotives. We recommend properly cleaned sized coal not to exceed 2½ in. by 0 as most economical for all mechanically fired locomotives that have not been adapted, as recommended, to economically handle smaller sizes, unless there is sufficient price differential to warrant. We recommend the use of coal as small or smaller than that which will pass through a 2-in. round hole screen opening for all mechanically fired locomotives that have been adapted to its economical use.

The report was signed by S. A. Dickson (chairman), supervisor of fuel economy, Alton; G. B. Curtis, road foreman of engines, R. F. & P.; E. G. Sanders, fuel conservation engineer, A. T. & S. F, and W. J. Tapp, superintendent of fuel conservation, D. & R. G. W.

Combustion-Gas Turbines for Locomotives

A review of recent developments in Europe and the United States—Further proposals for a hydraulic transmission

L. P. Michael, Chairman

Developments have been made in foreign countries and also in this country which are not only worthy of consideration but which should be recorded as definite progress in the construction and use in actual service of combustion gas turbine equipment for producing power from low-grade fuel.

As a description and a record of what has been done in foreign countries, there was printed in the English magazine "Engineering" of April, 1942, an article entitled "The Jubilee of Brown, Boveri & Company." Among the developments which Brown, Boveri & Company had made, was a combustion gas-turbine locomotive for the Swiss State Railways. This article not only described this equipment but also showed several cuts and photographs of it. The locomotive, which uses gas oil, has a rating of 2,200 hp. and a maximum speed of 66 miles an hour. The gas turbine drives a generator providing current for the traction motors on the lines of a Diesel electric locomotive.

Fig. 2, on Plate I, in this issue, also relates to the Jubilee celebration exhibitions, and illustrates what was described as a 1,500 kw. pulverized-coal turbine. Actually it is a gas turbine, with its compressor, in which the fuel gas is produced from pulverized coal. In view of the fact that the great portion of fuel for locomotives in this country is coal, it will be of further interest to know that there are possibilities of continuing its use as fuel when the combustion-gas-turbine engine locomotive is developed.

The latest information on the combustion gas turbine in this country is covered in an article "The Gas Turbine," written by Dr. J. T. Rettaliata, steam turbine department, Allis-Chalmers Manufacturing Company, and is printed in parts I, II, and III in the Allis-Chalmers Electrical Review, September and December, 1941 and March 1942.

This article gives a historical resume of the gas turbine from Nero's time, 130 B.C., to date, and covers the thermodynamics, the thermal efficiency, construction and actual application of this prime mover. Part III concludes with a brief description of the Brown, Boveri Gas turbine-electric locomotive built for the Swiss State Railways, and also gives a photograph of the 2,200 hp. gas-turbo-electric power unit for this locomotive.

An arrangement diagram of a 5,000 hp. hydraulic transmission, locomotive weighing 112 lb. per rail horsepower and capable of speeds up to 120 m.p.h., is shown in this part of the article. Final conclusions in part III are as follows:

"A recapitulation of the material herein presented indicates that the future of the gas turbine becomes more promising with the adoption of higher temperatures. Continued metallurgical advances and effective cooling methods bring operation at elevated temperatures ever closer to the realm of practicability.

"Field experience with the units already in operation

indicates their design to be conservative, and no troubles attributable to operating temperatures have been encountered. Based upon this experience, as well as that of supercharger work, it is believed that operation at temperatures higher than those now in use is entirely feasible and that it can be accomplished with an adequate margin of safety.

"Improvement in thermal efficency, made possible by the use of regeneration and increased temperatures, makes the gas turbine a serious aspirant as a prime mover for certain applications. Because of the low grade of fuel it can use, the gas turbine, even when operating at present temperature levels without regeneration, compares favorably on a fuel cost basis with other methods of power production.

"Undoubtedly the gas turbine has certain natural applications which make the cycle appear attractive. The advantages associated with the elimination of the high pressure, high temperature steam boilers, and the attendant feedwater problems from a power plant are obvious. At present the cycle is only applicable where liquid or gaseous fuels can be used although research has shown some promise for the application of pulverized fuel for this service.

"The gas turbine is not regarded as the answer to all power problems since its limitations are well recognized. It is believed, however, that it possesses definite features which ideally adapt it for certain classes of service; and it is toward this end that the present development is being directed."

Gas Turbines for Air Craft Superchargers

Since the above article was written, the Allis-Chalmers Mfg. Co. have advised as follows:

"Allis-Chalmers is now actively engaged in the construction of turbo-superchargers for aircraft. The experience that is being gained through this activity should aid us greatly in our other gas turbine pursuits.

"We wish to point out that our activities in the gas turbine field have been primarily concerned with the development of a highly efficient, light weight unit as we believe that this is the basic objective to be accomplished. After it has been demonstrated that it is possible to construct such a unit, then adapting it to locomotive, marine, or other types of drives is mainly a matter of application. Therefore, even though in our present studies a great deal of time is not being devoted to the locomotive application itself, we believe it will be understood that the work which we are doing is of prime importance and a contributory factor to a successful locomotive design.

"The Battelle Memorial Institute is conducting an extensive research program on high temperature materials for us. The results obtained so far from this research are highly promising and the indications are that materials are now available which have especially good properties. One limiting feature in the design of a high temperature gas turbine appears to be the creep rate of the materials employed. Materials are now available which have creep rates of 1 per cent in 100,000 hours (11.4 years) at a temperature of 1,500 deg. F. and a stress of approximately 4,500 lb. per sq. in.

"Our design studies of high-temperature gas turbine units have laid particular emphasis on adequate cooling of the various high temperature parts as this is of great importance in achieving successful operation."

The above reports on the progress and development made on the combustion gas turbine are certainly very encouraging and this Committee has proceeded to outline a gas turbine application to a 6,000-hp. locomotive with single cab carried on two six-wheel trucks, similar in arrangement to the one proposed in last year's report, except that the transmission of power from the two 3,000-hp. gas turbines, 1000 hp. to each pair of driving wheels on the trucks, will be considerably simplified.

Careful checking indicates that the transmission of 3,000 hp. to each of the two six-wheel trucks can be made through two sets instead of four sets of hydraulic torque converters and couplings, one set for forward and one set for reverse motion of the locomotive. The hydraulic torque converters will increase the starting tractive force, similar to the low gear on an automobile transmission, and the hydraulic couplings will transmit the power from the turbines to the driving wheels, at higher speeds, efficiently cushioned and without shock to the shafts and gearing in the power transmission.

The hydraulic torque converters and couplings also provide a very practical, rugged and efficient means of reversing the direction of movement of the locomotive in that they can be so arranged and geared that by using two sets, one set geared to drive the locomotive in one direction and the other set to drive in the opposite direction, and the hydraulic fluid (oil) delivered only into the one set giving the direction of movement of the locomotive as desired, while the other set is idling, with very low resistance, in the opposite direction.

A Proposed Locomotive Transmission System

In the design of the proposed locomotive, the speed of the 3,000-hp. gas-turbine shafts will be about 6,000 r.p.m. at a speed of 120, or 4,000 r.p.m. at 80 m.p.h. for the locomotive. This turbine-shaft speed will be geared down to about 2,400 r.p.m. at 120, or 1,600 r.p.m. at 80 m.p.h. of the locomotive, for the hydraulic torque converters and couplings.

At full load, from about 70 or 80 m.p.h. and upward, the hydraulic couplings will be turning about two per cent faster than the driving shaft to the trucks, on account of the cushioning and slippage of the fluid in the hydraulic couplings.

The shaft from the hydraulic couplings to the driving wheels is to be of dynamic steel tubing and is to have two universal joints in it between the hydraulic coupling and the driving axle and also between the three driving axles in each truck.

Each driving axle is to be equipped with a 42-in. pitch-diameter, 70-tooth hypoid gear which is to mesh with a 23-tooth pinion on the driving shaft. The gear to pinion ratio is, therefore, 3.04348.

It is proposed to use Timken tapered roller bearings on the driving shaft and on the axle carrying the housing for the hypoid gear and pinion and also for the driving axle bearings carrying the weight of the locomotive.

It is planned that the speed in revolutions per minute of the pinion, driving shaft and universal joints will be approximately the same as the speed in r.p.m. of the 500-hp. motor armatures on the Diesel-electric locomotives used on the streamline trains now in service. This speed is about 2,350 r.p.m. at 120 m.p.h. for the locomotive. The armatures on these motors range from 18 in. to 20 in. outside diameter.

It is proposed to make the centers of $3\frac{1}{16}$ in. diameter by $2\frac{5}{8}$ in. long bearings on the universal-joint pins travel in a 17-in. circle and the outside of the pin-bearing housing about 21 in. in diameter.

In other words, the peripheral speed of the center of the universal joint pin bearings will be less than the peripheral speed of the outside of the armatures on the 500 hp. motors used on the Diesel-electric locomotives in road service. The outside ends of the housings for the universal joint pins will travel at a proportionately higher speed.

Further, with the gear ratio proposed, the peripheral speed of the center of the universal-joint pin bearings will be approximately the same as the outside tread of the 52-in. driving wheels and therefore is the same as the speed of the locomotive. Therefore, the bearing pressure on each pair of universal joint pins, nearest to the hydraulic couplings, will be the same as the drawbar pull exerted by each truck, which may be operated separately or both may be operated at the same time.

In the design which has been outlined for the universal joints it is proposed to use pressed-in removable bearing pins with surfaces treated to given a high Brinell, after which they will be ground to the correct size and finish. It is proposed to use Super-Oilite 16 bearings, oil sealed, for the universal-joint pins.

The combustion gas-turbine locomotive proposed in this report will have one cab about 80 ft. long, about 10 ft. 4 in. wide and about 15 ft. 3 in. high, and have a dimension of about 83 ft. over pulling faces of couplers, which is practically the same as this dimension for the full sized cars used on the modern streamlined trains now in service.

The wheel base of this locomotive will be about 71 ft. The weight, fully loaded ready for service, is estimated not to exceed 420,000 lb., which would be 70,000 lb. per pair of wheels, at the rail, for the six pairs of wheels which are to be 52 in. in diameter, steel tired. This weight will include 35,000 lb. of fuel oil and 25,000 lb. of water for the boilers required to furnish steam for car heating.

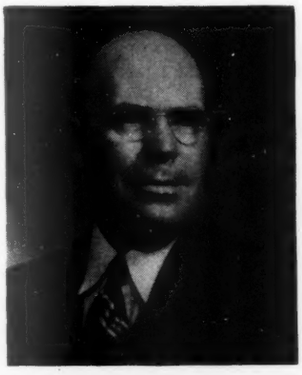
The weight of the locomotive light, except for sand, lubricating oil and supplies, is estimated at about 360,000 lb., which would be 60,000 lb. for pair of wheels at the rail. The tractive force, with all six pairs of wheels driving will be about 90,000 lb. which will give a factor of adhesion of four with the light weight of the locomotive, or a factor of adhesion of 4.666 with the locomotive fully loaded.

In other words, this design provides a 6,000-hp. locomotive weighing 420,000 lb. or 70 lb. per hp., which is less than half that required for the Diesel-electric locomotives now in road service.

The report was signed by L. P. Michael, chairman, chief mechanical engineer, C. & N. W.

Diesel-Electric Problems of the Road Foreman

Instructions for enginemen in handling the controls of Diesel-electric switchers to protect the electrical equipment



W. D. Quarles, Chairman

In yard service the engine crews operate Diesel-electric locomotives without the assistance of a trained supervisor other than the road foreman of engines. Therefore, the road foreman must obtain sufficient knowledge of the equipment to enable him to impart such knowledge to engine crews in order to perfect their ability to perform with reasonable satisfaction. The engineman must first be taught the correct procedure in starting and stopping the Diesel engine. If the engine does not rotate when the starter button is engaged, he must make sure that all controls and switches are in the correct position and starting contactors operate when the starter button is engaged. If all circuits are found to be correct and the engine will not rotate fast enough, then try to start with half of the relief valves open, preferably in firing order. When the engine starts, the starter button must not be released until the engine has assumed sufficient speed to reduce the current flow in the starting circuit to prevent burning and pitting the starting contactors. Before moving the locomotive air pressure must be high enough to operate reverser and power switches for a good electrical connection in addition to having an adequate supply of air for the brakes.

It is most important that the temperature of the engine be controlled within the operating range of 150-170 deg. Low temperature lowers the overall efficiency of the Diesel engine due to improper combustion. Water, being a product of combustion, condenses on the walls of comparatively cool liners, interfering with lubrication and possibly combining with carbon-dioxide, another agent of combustion to form carbonic acid which acts on the metal of the liner and piston, causing wear at a rate three times faster than normal. Varying temperature (hot to cold) sets up stresses due to expansion and contraction of parts of the engine, causing cracked heads, liners, piston and leaking gaskets. High temperature of lubricating oil will cause a heavy carbon formation. If the Diesel engine responds to throttle operation but the locomotive will not move it will be necessary for the engineman to check reverser, power switches, exciter or battery field circuit for defects such as a blown fuse or poor electrical connection on contactors, relays, or relay interlocks. A locomotive should never be run over a track on which water is over the rails without some competent person preceding it and measuring the depth of water. If not in excess of 5 in. the locomotive can be drifted through with power off the traction motors at a speed not over two to three miles per hour, after which an inspection must be made of the traction motors by removing inspection covers to determine if the moisture has evaporated. Power should not be again applied to motors until they are known to be free of all moisture. If the engineman does not see the water in time to take the action mentioned he should immediately close the throttle to idle even though it required closing the throttle without proper time element.

Excessive use of sand is objectionable to the elec-

trical equipment, having an abrasive effect on the commutator and motor bearings. Its accumulation on the equipment will conduct the high voltage circuit to ground particularly when wet. Sand must never be used when wheels are spinning. While this is a lesson learned with steam-locomotive operation, it is more important with Diesel-electric as the fly-wheel action of the motor armature will overstress the pinion gear when the wheel to which it is geared is too suddenly brought to rest. Overstressing of the gears also occurs when brakes are used while power is applied.

On some Diesel switchers, through a scheme of wiring in the control circuit, the reversing drum and power switch are synchronized with the reversing lever and, with this arrangement, if the motor fields are reversed while the locomotive is moving, considerable damage might occur to the electrical equipment by regeneration from the traction motors. Therefore, never shift the reverser until the locomotive is at rest. Where the air compressor is connected to the crank shaft and it is necessary to pump up air while the locomotive is in motion, kill the excitation on the main generator before opening the throttle as this will disconnect the motors.

Slid-flat power wheels have a very detrimental effect on traction-motor windings. Therefore, skidding can and must be avoided. There is nothing inherent about a Diesel which will contribute to sliding wheels. On the contrary the fly-wheel action of the traction-motor armatures tend to keep the wheels rolling against braking force. While this is more or less true there have been many flat wheels on this type of locomotive. Invariably they are caused by improper brake manipulation. The engineman, in switching off cars, should endeavor to stretch the slack with light cylinder pressure before developing the maximum obtainable. By so doing there will be no heavy change of slack to shift the weight from the locomotive wheels to reduce the adhesion; it is a lack of adhesion which will cause the wheels to slide with a given braking force under normal conditions. With bad rail conditions the engineman should apply that same good judgment which he was taught to apply when handling other types of power. All should understand that with any electrical transmission a derailed power truck must never be rerailed by aid from the derailed truck as the wheels would ordinarily spin when power is applied, and all traction motors being of the series type, having certain inherent characteristics, this sudden spinning of the unloaded wheel is liable to cause the motor armature speed to increase to dangerous proportions, wrecking the entire motor. While switching locomotives are mentioned, the foregoing is applicable to Diesel freight or passenger operation.

The road foreman of engines in steam locomotive operation had the problem of the human equation in getting enginemen to handle steam engines so as to get maximum efficiency from the machine by co-ordination of the reverse lever and throttle manipulation. Some enginemen seemingly could not make the time or negotiate the ruling grade with a tonnage with which others experienced no trouble whatever. This difference in enginemen was somewhat narrowed by the valve pilot and back-pressure gauge. With Diesel power there is no difference between enginemen in this respect as the Diesel engines respond the same for any engineman in a given throttle position. However, the road foreman of engines does have a problem in the Diesel operation far greater than that of steam. It is true that the Diesel engine is protected from overloading by automatic electro-mechanical devices, but there is no protection afforded the electric transmission. The road foreman is faced with the problem of protecting this by training enginemen never to stop with the power applied and never attempt to start until the brakes are fully released and always to operate with the traction motors in the correct operating characteristic corresponding to the speed.

Traction motors used for Diesel-electric motive power are almost invariably of the series type. In operating a train with this type of motor any increase in grade which causes the train to slow down results in an increase in current flow. Increase in current flow causes increases in temperature. If the motor and generator are then subjected to temperature higher than the critical for the insulation, the insulation becomes charred. It is this overheating which the engineman prevents when complying with operating instructions and with which the road foreman must insist on full compliance.

The report was signed by W. D. Quarles (chairman), general mechanical instructor, A. C. L.

Locomotive Maintenance Officers' Association

(*Continued from page 478*)

him for greater responsibility, but make him even more valuable as his career advances.

Make Supervisor Part of Official Family

The final thought this committee would like to leave with you is that as soon as a man is made a supervisor, he should be made to feel that he has become a part of the official family. To this end, treat him so that it will be evident to him and to all other employees. See that he is given full information on the company's policies in all matters which he handles. Let him know that he is to be the advisor of his immediate superior. Don't countenance one supervisor going over the head of another in giving orders, seeking advice or in the administration of discipline. Give him a place at your production, routing, safety and other shop activity conferences. Encourage him to express his opinions. Where they are not sound, explain the fallacy in them to him patiently but thoroughly. When they are sound, let him know that they are appreciated and if it is possible to put them into effect see that he is credited with them. Increase his responsibilities as he shows himself able to assume them and let his promotion be in the same proportion.

It is our firm belief that the recommendations heretofore expressed on the selection, procurement and training of supervisors, if followed, will produce an organization which will function smoothly and efficiently, will be amenable to rapid expansion under increased load and at the same time be loyal and understanding in adversity.

The report was submitted by F. K. Mitchell (chairman), assistant general superintendent motive power and rolling stock, New York Central, New York; C. P. Brooks, mechanical engineer, Erie, Cleveland, Ohio; Elmer Butler, assistant production engineer, Missouri Pacific, Little Rock, Ark; K. Berg, superintendent motive power, Pittsburgh & Lake Erie, McKees Rocks, Pa.; W. W. Haggard, general foreman, locomotive department, Atchison, Topeka & Santa Fe, Topeka, Kan.; W. V. Hinerman, assistant to superintendent motive power, Chesapeake & Ohio, Richmond, Va.; T. B. Roberts, supervisor apprentices, Lehigh Valley, Sayre, Pa.; H. J. Schulthess, chief personnel, Denver & Rio Grande Western, Denver, Colo.; J. A. Malsi, apprentice instructor, Louisville & Nashville, Louisville, Ky.; A. H. Williams, general supervisor apprentice training, Canadian National, Montreal, Que., and Roy V. Wright, editor, *Railway Mechanical Engineer*, New York.

Constructive Reports on Car Subjects

(*Continued from page 469*)

word "Owner" at the end of the second to the last sentence place comma, and add the following: "and the cost of movement to such designated point shall be assumed by car owner in the absence of any other agreement for disposition of such transportation costs."

Reason.—To clarify that owner desiring car to be returned home must assume all expense involved, including the transportation costs involved.

Passenger Car Rule 7

Rewrite Sec. J in its entirety as follows:

U Type Valves

Not cleaned within 15 months, as indicated by standard markings, must be cleaned.

Not cleaned within 14 months, as indicated by standard markings, may be cleaned regardless of whether car requires other repairs.

Equalizing or quick-action portions, or brake cylinders may be cleaned separately, including separate stenciling, if defective within 12 months. In the event either part becomes defective after 12 months the entire brake system must be cleaned.

Slack adjusters must be cleaned each time brake cylinder is cleaned.

Retaining valve and centrifugal dirt collector must be cleaned each time any part of this equipment is cleaned.

Other Than U Type Valves

Not cleaned within 12 months, as indicated by standard markings, must be cleaned.

Not cleaned within 11 months, as indicated by standard markings, may be cleaned regardless of whether car requires other repairs.

Triple valve, brake cylinder, retaining valve, slack adjuster and centrifugal dirt collector must all be cleaned at the same time.

L-2 triple valves applied in repairs must be equipped with Westinghouse graduating spring and cap nut (piece Nos. 92073 and 92074) for which additional charge is permissible.

This includes D-22 type brake equipment.

General

The place, month, day and year of last cleaning and oiling and the initials or name of road to be stencilled with white paint in a suitable location for inspection.

Valves cleaned must be removed from car and tested in accordance with A.A.R. standard code of tests for repaired triple valves, including the checking with A.A.R. standard triple valve wear limit gages, suitable for the particular type valve being cleaned.

Provisions of Sections (h), (i), (j), (k) and note following Sec. (k) of freight car Rule 60 are applicable.

Note—When brake system is cleaned water-raising system must also be cleaned.

Reason.—To make for more ready reference. To provide for the cleaning of brake equipment at a time when the cars are idle, thus avoiding their being delayed under load or their empty movement in the direction of loading points being interrupted, thus increasing the availability of passenger car equipment, carrying cars as well as head end and express refrigerator cars. Also to incorporate into the passenger section certain provisions of the freight rules that have proven by test to be of benefit.

Eliminate Sec. K. Entirely.

Reason.—The listing of the amount of piston travel in the freight car rules is not deemed necessary as this feature is covered by general instructions. It should, therefore, not be necessary in the passenger section. The present listing is in conflict with good practices, the D-22 type system as well as the truck mounted AB-type cylinders require less travel than is specified in the present rule. To list a measurement for one type of brake would require the listing of the proper travel for all types. This appears unnecessary in a code of interchange rules.

Eliminate Interpretation 2 entirely.

Reason.—Covered in revised Sec. (j) of this rule.

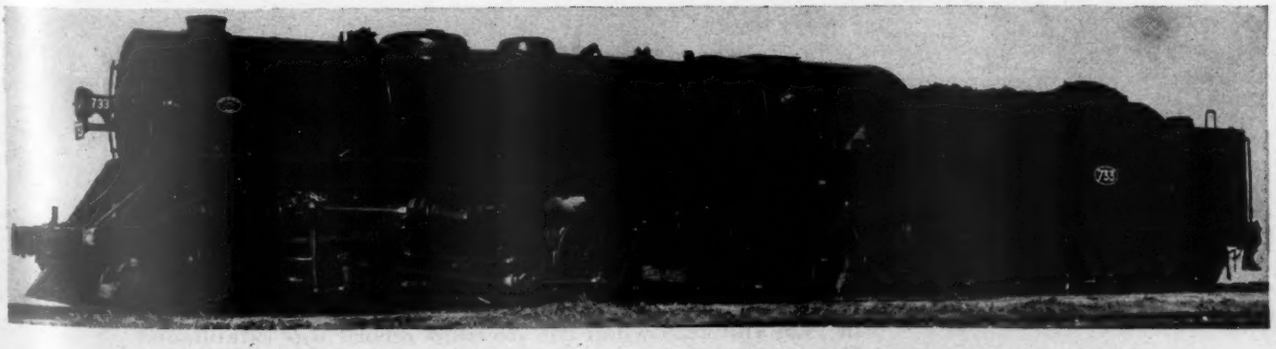
Passenger Car Rule 22

In Item 2, recommend that separate allowance be incorporated in this rule to cover application of brake shoes on streamlined cars.

Reason.—Present allowance is far below the actual cost of application, due to inaccessibility involving much more labor than is required on the ordinary car.

The report was submitted by E. G. Bishop (chairman), general car foreman, Illinois Central, East St. Louis, Ill.; D. E. Bell (vice-chairman), A. A. R. instructor, Canadian National, Winnipeg, Manitoba, Can.; W. J. Burns, mechanical inspector, General American Transportation Corporation, Chicago; F. McElroy, chief clerk to vice-president, Union Tank Car Company, Chicago; C. A. Erickson, general A.A.R. inspector, Chicago & North Western, Chicago; M. E. Fitzgerald, master car builder, Chicago & Eastern Illinois, Danville, Ill.; C. W. Kimball, assistant supervisor of car inspection, Southern, Atlanta, Ga.; F. J. Larrissey, chief A.A.R. inspector, Erie, Cleveland, Ohio; J. E. Mehan, assistant to superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; C. A. Mick, chief clerk-mechanical, C. B. & Q., Chicago; F. H. Stremmel, assistant to secretary, Mechanical Division, A.A.R., Chicago; C. R. Wiegmann, chief interchange inspector, St. Louis-East St. Louis, Terminal District, St. Louis, Ill.

* * *



One of nine 2-8-4 type locomotives now being built at the Islington workshops of the South Australian Railways

Photo from St. Louis-San Francisco, Springfield, Mo.

The Equipment Department Renders Distinguished Service

For the first time on American Railroads steam locomotives out of service for repairs are less than 7 per cent of steam locomotives on line and bad-order freight cars less than 5 per cent—On September 1 out-of-service locomotives were 6.6 per cent and bad-order cars 3.1 per cent—Freight locomotives made over 67 million miles and freight cars over three billion miles in August, more than the highest months in 1928 and 1929 when the previous record was established—Many railroad shops are also participating in war production

The Effects of a Good Housecleaning

For years those in charge of shops and enginehouses have resorted to all kinds of methods to get supervisors and workmen to clean things up and keep them clean. Natural pride will cause some people to keep the places where they work and the things they work with in a clean and orderly condition. Others are just naturally sloppy. That's why an ingenious supervisor invented the prize award for the dirtiest department in the shop.

Along comes the war, with shortages of rubber, copper, alloy steels, tools, and almost everything else that we need to carry on the job. One of the first things that could be done was to pick up the things that could be used—or sold for scrap. In the process there came to light thousands of pounds of materials that are now almost worth their weight in gold.

It took the housecleaning to find out where we stood. Having found that out, most shops are finally being forced to do the things they should have done years ago—for their own good. War is not without its benefits, but it's a hard way to learn.

Measuring Locomotive Performance

Hardly anything looms larger in the mind of the average mechanical officer, today, than the question of what means can be employed to spread his motive power inventory over a more or less extensive operating territory in such a way as to have locomotives available for all trains when and where needed. With freight traffic increased relatively nine times as much in the last two years as in the two years ending in 1929, for example, and passenger traffic, instead of declining, more than doubled in the same period, the problem of finding enough motive power to go around is a very real one.

According to J. J. Pelley, president of the Association of American Railroads, the proper government agencies are now being asked to authorize the building of 900 new locomotives during the year ending October 1, 1943. But, in the meantime, railroads must move present traffic with the motive power now available. This implies a high degree of utilization which is, of course, impossible without some good measuring stick of locomotive performance to determine where the weak points are and permit correcting them.

Apparently locomotive miles per month is the most commonly used gage of locomotive service and also the one most generally satisfactory in spite of some rather definite limitations. For example, 6,000 miles a month was formerly considered pretty good performance and still is the best average figure obtainable under certain conditions. That being the case, how account for records of 15,000, 17,000 or even 20,000 miles a month now being quoted as secured with steam power in some instances?

The first thing which must be known in comparing locomotive monthly mileage figures is the class of service, as freight power can be expected to make on the average only about two-thirds as many miles a month as passenger power. The use of certain locomotives in both passenger and freight service of course complicates the picture and must be duly allowed for to make any accurate comparisons. It is also important to know the kind of territory in which the locomotives operate, whether level and relatively straight, or mountainous and curving, whether largely main through-line, or including a large proportion of straggling branch lines.

The next consideration is the number of locomotives involved in the comparison, as it is entirely possible to achieve monthly mileages approaching 20,000 with one or possibly a dozen new passenger locomotives receiving special attention under unusually favorable operating conditions as regards long, through runs and short turning time, whereas the average monthly mileage of the entire locomotive ownership on the same road may be exceptionally low. The number of locomotives involved in any comparative performance study is important.

Other factors bearing on the question of how many miles can be produced periodically with a certain class of locomotives include, as suggested above, whether they are new or just out of the shop, whether they are equipped with roller bearings, what their mechanical condition is, what kind of fuel and water are available for use, etc. Operating conditions also have a vital influence on locomotive mileage and the great number of trains now on many of the roads definitely tend to reduce possible monthly mileage in some instances where second-class trains have to take sidings and wait for connections, causing motive power to take much longer than usual in negotiating the same distance. This would naturally invalidate comparisons even of the same type of power on the same division with some period when line congestion did not operate to delay trains.

Locomotive monthly mileage figures, properly compiled and interpreted with care are, in spite of what has been said, a good basis for measuring the efficiency of locomotive use. They should be supplemented, however, wherever possible by analysis on a time basis to show actual locomotive daily hours on the road and hours at the terminal, either undergoing conditioning and repairs, or OK'd awaiting service assignment. Another measuring stick which reflects road performance, was suggested by Mr. Pelley recently when he said that railroads handled 25 per cent more gross ton-miles per active locomotive per month in October, 1942, than in October, 1939.

This exceptional performance shows that, measuring stick or no measuring stick, the railroads know how to get results with their motive power and the present order of the day is "Continue and extend this good work."

No Conventions—A Loss To the Railroads

For the motive-power and rolling-stock departments 1942 will go down in history as another year of no meetings. From the Mechanical Division down, all meetings, plans for which were formulated after the meetings in 1941, were cancelled. In this respect the year is like the depression years, when railroads were too poor and supervisors too insecure to give serious thought to association business.

Then, as now, the Mechanical Division continued the work of most of its committees under the direction of a continuously functioning General Committee. But the so-called minor mechanical associations were cut adrift and, when improved business conditions removed the primary cause for the discontinuance of their work, their revival was in spite of rather than because of the official support they received from mechanical department officers generally or from the Mechanical Division.

The present reasons for a no-meeting year are far different from those which prevailed during the depression. The nation is in the midst of the most desperate struggle of its entire history. The traffic which the railroads have to move is rapidly using up the last margin of reserve of facilities and manpower alike. Some of the materials needed for repairs are not easy to get; new cars and locomotives are still harder to get. Obviously supervisors cannot be spared unless the time they take away from their jobs adds more to their effectiveness than the value of the time lost.

Among the departments of the railroads there is evidence of a marked difference of opinion on the question of the value of time spent at conventions. The American Association of Railroad Superintendents held its annual meeting on May 12-14 and has the dates set for a meeting in 1943. The Roadmasters' and Maintenance of Way Association of America held its annual meeting on September 15-17. The American Railway Bridge and Building Association held its annual meeting on October 20-22. Here is evidence that in at least two of the major departments of the railway organization there is a belief that in times of stress, as well as in normal times, the inspiration which comes from the meeting of minds and personal exchange of experiences at association meetings is of sufficient value to justify the time required for attendance.

The time lost from their posts by the men who attend conventions is a tangible loss—even though the actual effect of the absence of a supervisor, prepared for in advance, may be hard to detect. But the benefits gathered from attendance are too intangible to be measured immediately. The record indicates that the leadership in the mechanical department is less gifted than that of some other departments with the imagination, or the insight into human nature, which makes it possible to understand the value of inspiration and the challenge of a free exchange of ideas in finding solutions of new problems or better means of dealing with old problems. Like every other means of communication, convention attendance speeds up progress.

The officers of the four coordinated mechanical associations, understanding the value of association work, have shown the determination to salvage from the situation caused by the cancellation of their meetings the utmost which the circumstances permit. All have prepared the material for convention programs, the quality of which may be judged by the readers of this issue. Thus the morale of the associations themselves is being fostered and their members are receiving a useful part of the service the associations are set up to perform. But the railroads are the losers because their supervisors have been deprived of that part of the service which can be rendered only when they are in attendance at the annual meetings of their associations.

New Books

WELDING HANDBOOK. *1942 edition. Published by the American Welding Society, 33 West 39th Street, New York. 1,593 pages. Illustrated. Price, $6.00 in the United States, $6.50 elsewhere.*

This is the second edition of the most comprehensive welding publication edited in the United States and includes within its covers the consensus of opinion about all fields of welding. The volume has been prepared to cover, first, the physics and metallurgy of welding and the weldability of steels; second, welding and allied processes; third, materials used; fourth, training, inspection and safety; fifth, design considerations and methods of weld testing and sixth, industrial application of various welding processes.

The index of authors lists the names of 270 individuals who have contributed to the preparation of various portions of the volume. According to the statement of the Welding Society, its aim was to make sure that statements were accurate and recommendations authoritative. Chapter preparations were left to individual committees which, though composed of members from different fields, recognized the desirability of the impartial treatment of subject matter.

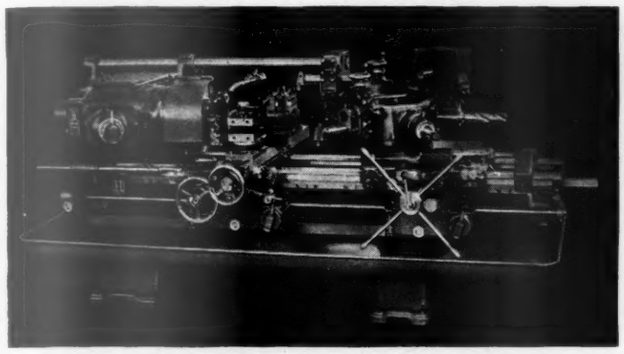
The section on railroads, beginning on page 1405, covers the major developments in the use of welding in car and locomotive construction as well as the outstanding applications of welding to equipment and track repairs. The members of the committee preparing this chapter represented selections from Federal agencies, steel companies, welding equipment and supply companies, private car builders and the railroads.

No railroad library, if the railroad does any welding at all, should be without a copy of this book. It gives users an authoritative, up-to-date source of reference on all technical phases of welding at the same time that, in most chapters, it is so written that non-technically trained men will be able to benefit by consulting it.

NEW DEVICES

Turret Lathes

The Jones & Lamson Machine Company, Springfield, Vt., now has in production its 9A and 10A saddle-type universal turret lathes. The 9A machine has a maximum round-bar capacity of 3½ in. and will swing 23½ in. over the way covers, the 10A machine has a maximum round-bar capacity of 5 in. and will swing 27½ in. over the way covers. Among the features of these lathes are power traversing of the saddle and power indexing of the hexagon turret, both operated by one lever, through



Simplified controls on these turret lathes speed production

which both high and low positive traversing speeds can be obtained.

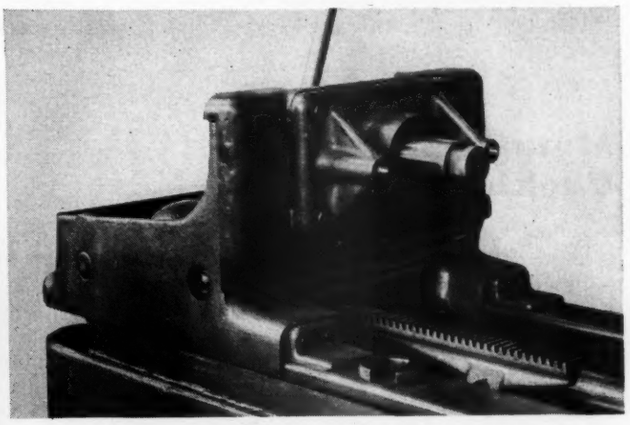
The heavy-duty headstock has an anti-friction transmission and spindle bearings throughout. A built-in power rapid traverse is provided for the bridge-type carriage and cross slide. This power rapid traverse has an all-gear drive and is operated by a single lever, through which all four movements can be obtained. The bar-feed mechanism is power operated. A reversible-torque motor controlled by an electric switch, located on the headstock of the machine within easy reach of the operator, actuates the stock feed-chuck lead screw through a gear train and either advances or withdraws stock as required.

Special Work-Holding Fixture For Threading Machines

A work-holding fixture which provides a means for accurately and rigidly supporting the work piece during the threading operation has recently been developed by the Landis Machine Company, Waynesboro, Pa.

The fixture has a work-aligning arbor on which the work is retained by a collar. A lever-operated cam arrangement at the rear end of the arbor provides a means for drawing and locking the work piece onto two driving and locating pins.

The fixture is fastened to a face plate which bolts on the machine carriage in place of the conventional carriage front or vise. It has both a horizontal and a vertical adjustment on the carriage to assure accurate and permanent alignment of the work piece with the center of rotation of the threading unit. The device was designed with a view of holding to extremely close tolerances for

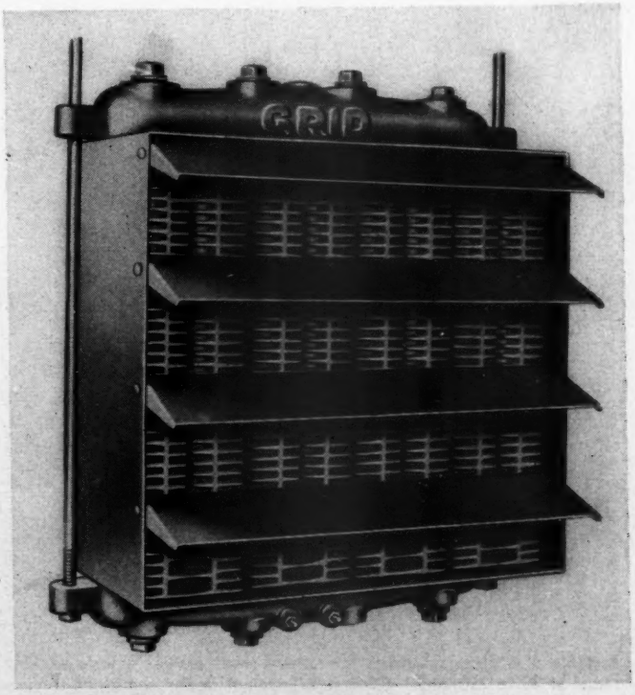


A fixture which provides accurate and rigid support in threading operations

thread concentricity, and to assure maximum production by eliminating the time otherwise required if the work piece was gripped in a conventional vise.

Shop Heating Units

The Grid Unit heaters manufactured by the D. J. Murray Mfg. Co., Wausau, Wis., have been redesigned to utilize cast iron in the heating sections instead of the aluminum of which these parts were formerly made.



Motor-driven heating unit for shops—The grids are cast iron

The units are designed and tested to operate with either steam or hot-water systems, operating on steam pressures from 2 lb. to 250 lb. A feature of these units is said to be a lower outlet temperature which produces a greater volume of air and more air changes per hour, increasing comfort in the working zone and reducing fuel costs. In the design of these heaters care was taken that dissimilar metals should not come in contact with each other in the presence of steam or hot water. Electrolysis is thereby prevented and added life assured. The units are motor-driven and are manufactured in a series of sizes to meet various shop requirements.

Metallic Plastic Packing

National Engineering Products, Inc., Washington, D. C., is marketing a metallic plastic packing under the trade name "Rodpax," which may be applied for many services. This type of packing is a combination of asbestos fiber, high melting point anti-friction metal, graphite and a special high-temperature-resisting lubricant, which, when compounded, forms a soft and plastic packing material which will retain its resiliency, and possesses a low coefficient of friction.

Rodpax in composition is always ready for instant use and does not require the use of end rings. After packing, under gland pressure, it forms into a solid homogeneous mass, and being impregnated with a lasting high-temperature lubricant, becomes a perfect compressed lubricated bearing.

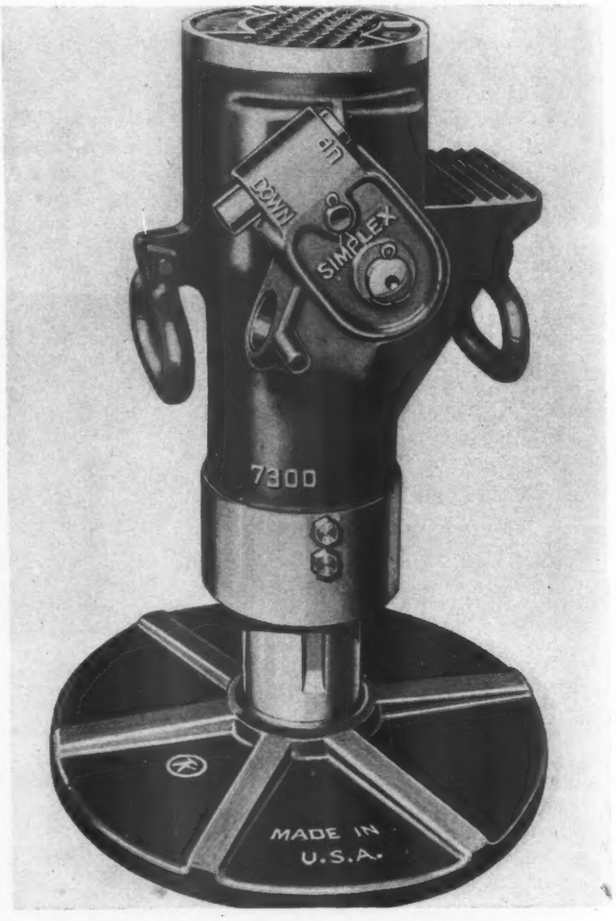
This packing is available in four standard grades which will meet nearly every condition, thus making possible considerable reduction in packing inventories. It will conform with any size and shape of stuffing box.

* * *

Portable a. c. Flexarc welders for railway shops provide a wide working range of 20 to 250 amp.—Current adjustment in any one of 27 steps is made by plugging into bayonet type receptacles—Built by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Speed Screw Jack

A 25-ton standard-speed, bevel-gear, ball-bearing screw jack is being manufactured by Templeton, Kenly & Co., Chicago. It is designed for heavy-duty lifting, lowering and skidding work. The jack has both toe and cap lift



A 25-ton jack which has a toe capacity of 12½ tons

arrangements, the toe lift being a minimum of 11 in. from the base in the standard model, although arrangements can be made to position the toe for special uses. The lifting capacity on the toe is 12½ tons and on the cap 25 tons. The operation of the jack is mechanical with a screw adjustment and enclosed ratchet mechanism.

Flame-Hardening Machine

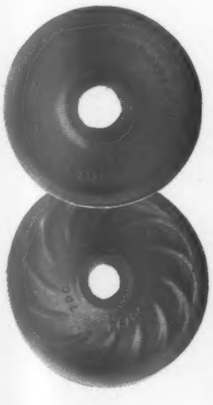
A flame hardening machine is being manufactured by the Hydraulic Machinery, Inc., 10421 Grand River, Detroit, Mich., for the surface hardening of small parts. The base and external housing structures of the machine are of welded steel design. Electrical control and the use of hydraulic power provides positive and flexible operation. Parts of the machine which might require adjustment and routine maintenance are on the outside. The pilot light, burners and water coolant are located on the rear slide and are adjustable. This feature together with proper shielding directs the flame and the

(*Continued on the next left-hand page*)

AMCCW INSPECTORS ON GUARD WITH THESE...

6 POSITIVE TESTS

SO EACH CHILLED WHEEL IS AS GOOD AS THE BEST



- Chill Test Block taken at least once in every ten wheels poured.
- One Complete Chemical Analysis Block with each heat.
- Constant Pyrometer checks for accurate process temperature.
- Drop Test of finished wheel (AAR specifications).
- Thermal Test of finished wheel (AAR specifications).
- Test for perfect rotundity.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

water to the exact surface desired and insures uniform results.

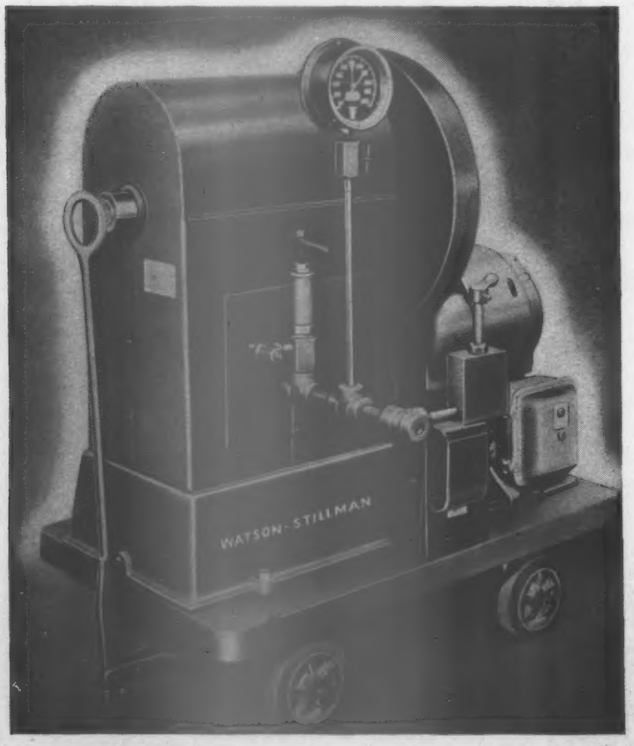
All working parts are adequately protected from the heat in the machine proper that might otherwise cause

Flame-hardening machine for the surface hardening of small parts

their distortion and misalignement. Water is used as a quenching medium and is sealed off from the actuating mechanism. The part to be hardened is manually loaded onto the index table of the machine, the pilot is positioned with a locating pin and after a starting button is pushed, the machine goes through its complete cycle of operation.

Portable Test Pump

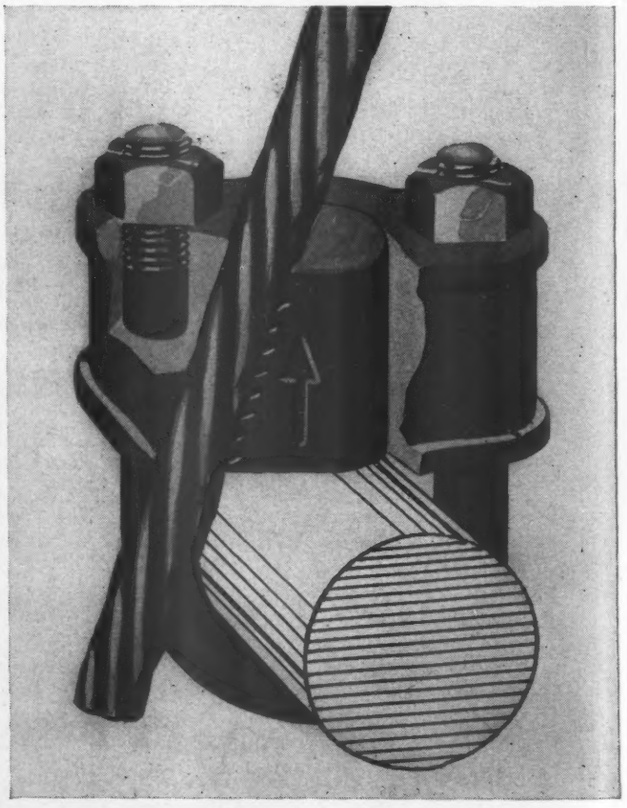
A motor-driven, portable test pump is being manufactured by the Watson-Stillman Co., Roselle, N. J., for use in testing boilers, tubing and high-pressure vessels. The entire unit, including the motor, is mounted on a hand truck and all parts are enclosed for protection against air-borne abrasives. The pump is a three-plunger, vertical type unit. The ½-in. diameter plungers have a 2-in. stroke. It is driven by a three horsepower motor at 100 r.p.m. and develops 8,200 lb. per sq. in. maximum pressure at ½ g.p.m. capacity. The equipment includes a pressure gage, a safety valve, a needle valve for pressure regulation, the motor, a motor starter and a disconecting switch. The entire unit is 50 in. long, 30 in. wide, 48 in. high and weighs 1,450 lb.



Portable test pump intended for use in testing boilers, tubing and high-pressure vessels

Brake Beam Safety Support Improved

The new type Universal brake beam safety support, developed by the Grip Nut Company, Chicago, and described in the February, 1942, *Railway Mechanical Engineer*, page 64, has been improved recently by two changes in design. Neither affects the fundamental operating principle of the device.



Malleable-iron fitting cut away to show how the cable is adjustable for length and held by a wedge insert

The Universal brake beam safety support is designed to prevent brake beams from dropping because of brake-hanger or brake-beam failure. It consists chiefly of two short lengths of double-galvanized cable per truck, connected to the brake-beam tension member by means of special iron fittings, and extending up to and over the truck bolster with about one inch clearance. The seven-

(*Continued on the next left-hand page*)

SPACE-TIME WAR!

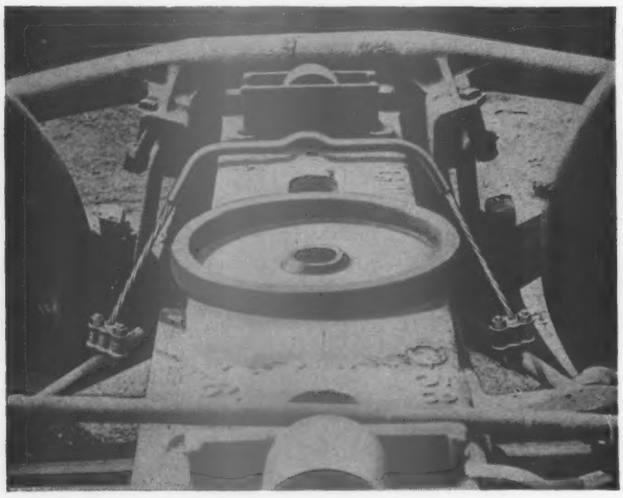
Today's military experts speak of "space-time" war as something new—but the railroads have been fighting, and winning, their war against space and time ever since the days of the Stourbridge Lion.

In their latest and most successful campaign, a campaign which started in 1925 with Lima's introduction of Modern Super-Power Steam Locomotives, the railroads have won a succession of outstanding victories over time and space, as evidenced by a series of new records in gross-ton-miles per train-hour.

And now, responding still further to the calls of war, the railroads are surging ahead to new levels of national service in their determination to carry more freight, more miles, in less time than ever before.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

strand semi-rigid cable is protected by a short section of enclosing pipe where it passes over the bolster, and is held in place by a kink or hump. One of the improvements is to change this kink or hump from a vertical to a horizontal plane, giving increased clearance between the top of the support and the bottom of the body bolster.



Adjustable Universal brake beam safety support applied to a freight car truck

In the original design, the cable ends were fixed or anchored in the malleable-iron fittings by expanding the wires at each end and filling the taper pockets with molten zinc in accordance with customary practice. Experience developed that this fixed cable length required a number of different lengths to allow for the necessary clearance. With the new fittings, cables can be adjusted to the desired length and then anchored by means of wedge inserts. The entire assembly is held in place with Grip Unit nuts tightened on the U-bolts.

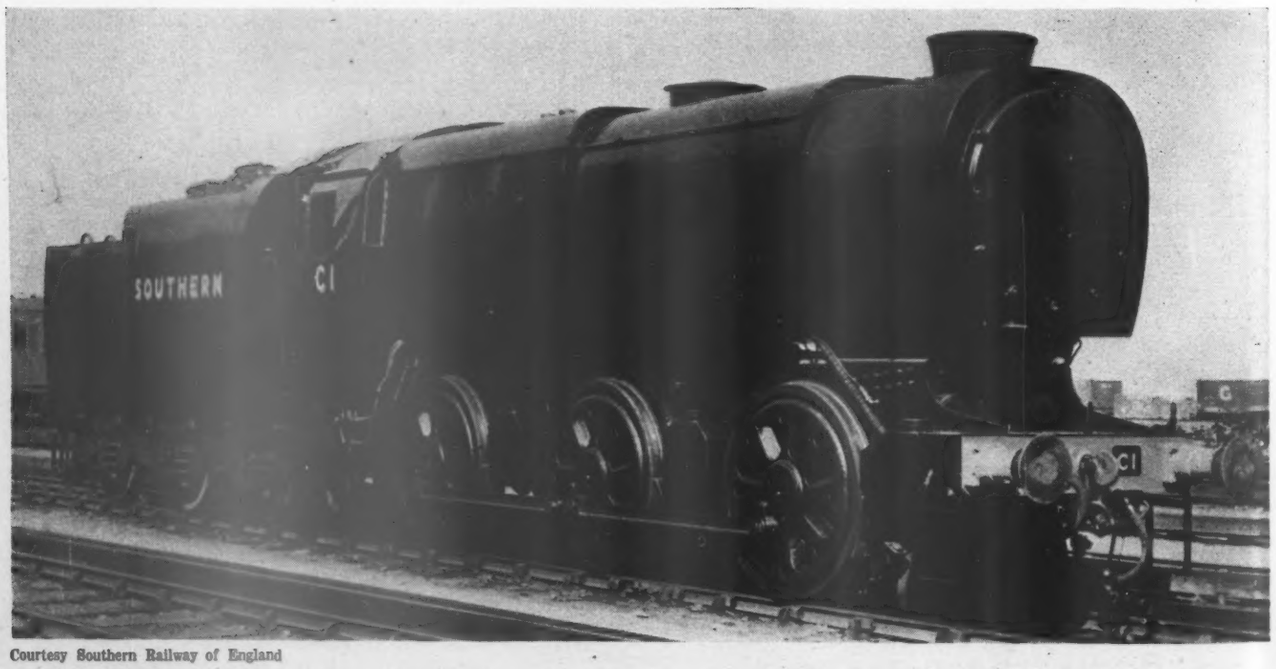
This device, which is an A. A. R. approved alternate standard can be fitted by easy adjustment to all types of freight car trucks, thus reducing the inventory of brake-beam safety supports which need be carried in stock. When renewing a brake beam, only one side of the support need be detached (R & R of four ½-in. nuts), which simplifies removal and replacement of the beam.

Side-Rod Bushings Machined With Alloy Tipped Tools

The machining of hard, sandy bronze side-rod bushings pierced with ⅜ in. lubricating holes was materially speeded by the use of Rexalloy tipped tools in one railroad shop, according to the Crucible Steel Company of America, New York, producers of these tools. Turning and facing operations, performed on an engine lathe, were done with an 11-in. travel at a speed of 150 surface feet per minute and a feed of 5/64 in. with a ½-in. square tool. The diameter of the bushing was 15 in. Previously, using high-speed steel tips, it had been necessary to regrind the tool during the operation; using Rexalloy the entire operation on the bushing was completed without the necessity of removing the tool from the holder.

Rexalloy tips have also been found to produce excellent results in both rough turning and finishing operations on manganese steels and on high-alloy tungsten steels.

* * *



Courtesy Southern Railway of England

The first of the "Austerity" class of mixed-traffic locomotives developed and built last Spring by the Southern Railway of England

No material has been wasted on trim. In the interests of accessibility to the valve motion and running gear, running boards and foot plates have been omitted. The enlarged smokebox permits removal of superheating elements and tubes without disturbing the steam pipes. The locomotive weighs 114,800 lb., all on the drivers. The tractive force is 30,000 lb.

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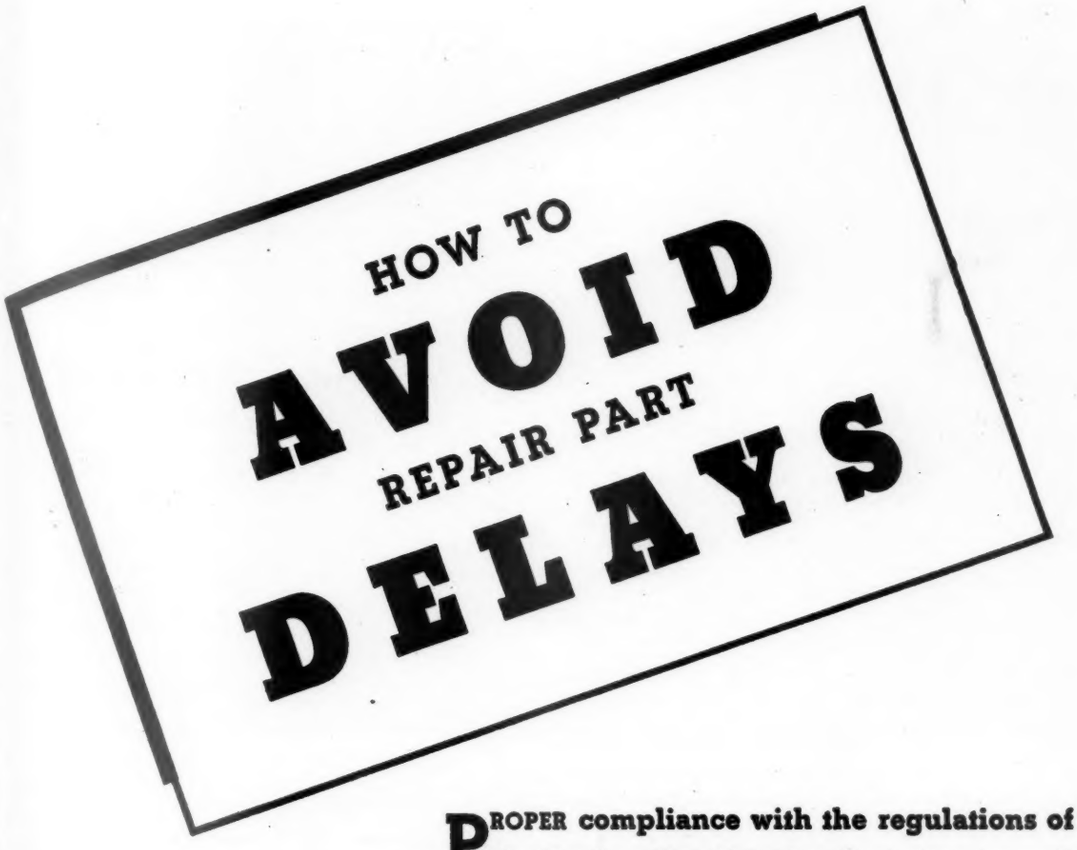

PROPER compliance with the regulations of the War Production Board is the first step towards getting repair parts promptly.

Verbal Orders cannot be accepted. The W.P.B. insists that shipment be made only against written orders showing a properly certified preference rating, end use symbols and required delivery date.

Since all material purchased is on the critical list and thus comes under the jurisdiction of W.P.B., we cannot enter the order until it contains all the required information.

Furthermore, all scheduling is based on priority rating so that an order with A-1-J rating, for example, is subordinate to a higher rating.

Therefore to expedite delivery we suggest you request the highest rating to which you are entitled.

Help us speed the shipment of repair parts by conforming with the W.P.B. regulations in every detail.

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High Spots in
Railway Affairs . . .

Essential Jobs—Transportation

The War Manpower Commission has certified that the transportation service "is an activity essential to the support of the war effort." The National Headquarters of the Selective Service System in its Bulletin No. 21 lists 116 railroad occupations—including express and forwarding services—that require "a reasonable degree of training, qualification or skill to perform the duties involved." The list is said to be restricted to occupations requiring six months or more of training and preparation. Local selective service boards in classifying registrants are asked to give consideration to: (a) The training, qualification, or skill required for the proper discharge of the duties involved in his occupation; (b) the training, qualification, or skill of the registrant to engage in his occupation; (c) the availability of persons with his qualification to replace the registrant and the time in which replacement can be made.

The Army Leases Alaskan Railroad

The Alaskan-Canadian military highway, which is under construction by the United States Corps of Engineers, is expected to be completed for military use by December 1. The White Pass & Yukon, a short line railway, will afford a rail connection from the highway, which passes through Whitehorse, Yukon Territory, Canada, a terminus of the railroad, to Skagway, Alaska, on the coast. This railroad has been leased by the United States Army for the duration and is already being operated by the Military Railway Service, with Major John E. Ausland, Corps of Engineers, in charge. Brig. Gen. Carl R. Gray, Jr., general manager of the Military Railway Service, with headquarters at St. Paul, Minn., said at a meeting of the Western Railway Club that operating difficulties are intensified during the winter months by temperatures as low as 72 deg. F. below zero and virtually continual gales of 35 miles an hour.

Stop Accidents—A Useless Waste

The Union Pacific has received a high and well merited tribute for its consistent low accident record in a "Report on Railroad Employee Accident Statistics," recently made by the Bureau of Transport Economics and Bureau of Safety of the Interstate Commerce Commission. A study of the Union Pacific files, the report said, indicated that "the low casualty rate on this railroad is due to an energetic policy of accident prevention which pervaded the entire organization, from general officers to section laborers." President W. M. Jeffers of that system has recently made an appeal by letter to all superintendents of schools in states traversed by it to enlist the school children in a "Stay Away from the Tracks" campaign. Specific instances are cited of serious damage done by thoughtless actions of children. "It is tragic, yes, unpatriotic," said President Jeffers, "at a time when the nation's railroads, and the thousands of men and women employed by them, are bending every effort to help win the war, that they and the entire country's war program should suffer serious setbacks through pranks of children." He suggests that every child be enlisted in the campaign "under an oath of honor."

Labor Union-Management Co-operative Committee

Director Eastman of the Office of Defense Transportation has emphasized that "among the lessons which war has taught us is that management and labor have a mutual interest in solving problems incident to the war effort." He has appointed a permanent joint committee of railroad officers and labor union leaders to function under ODT auspices. The functions of the committee will be to call attention to matters involving the railroads and their employees which may concern ODT; consultation with ODT on policies and activities which are of interest to employees and management; and enlisting the co-operation of employees, management, and their organizations for efficient and economic utilization of all transportation facilities for the duration of the war.

Women Workers In Unusual Jobs

In speaking before the annual meeting of the American Railway Magazine Editors William Edward Hayes of the Information Division of the ODT said that large numbers of women must be used on the railroads during the emergency. A preliminary list that had been prepared included car cleaners in coach and freight yards, cleaners in stations and offices, clerks of all sorts with the exception of yard clerks, claim investigators, crossing watchmen or crossing flagmen, information bureau attendants, photographers, photostatic operators, telephoners, telegraphers, ticket examiners, ticket collectors, timekeepers, crew dispatchers, engine dispatchers, dining car employees, riveters, station agents, steam hammer operators, switch tenders and welders.

Oil Shipments Are Slowed Up

For the week ending October 10, the latest for which records were available when this was written, the daily average of tank car shipments to the East Coast was only 766,410 barrels. This is the lowest for any week since July 18. The railroads were not responsible for this falling off. According to an OPC announcement there was an unavoidable 24-hour delay in the return of between 1,800 and 2,000 empty tank cars to the West for reloading, because of a traffic congestion on a particular railroad, which was handling special movements; tank cars were also transferred from petroleum service to the vegetable oil and related services, and this will probably be continued under a WPB priorities directive; it is also possible that cars of less than 7,000 gal. capacity, removed from East Coast service by ODT order, may not have been replaced by larger cars.

Loss and Damage Up

Payments for loss and damage to freight are increasing at a faster rate than freight revenues. This is unfortunate, particularly at a time when we can so ill afford to waste either transportation or commodities. Reports from 128 railroads in the United States and Canada show that the payments for the first six months of 1942 amounted to $15,572,717, as compared to $10,636,850 for a like period last year; this is an increase of $4,935,867, or 46.4 per cent. The rate of loss and damage payments to revenues of United States carriers increased from 0.51 per cent for the first six months of last year to 0.56 per cent for the first half of this year.

Railroaders Buy Bonds

In a "Railroad Edition" of its monthly publication, Payroll Savings News, the United States Treasury Department's war savings staff says that the American railroads, with more than a million and a half employees and a monthly payroll of about $270,000,000 are "headed full speed toward the goal" of 10 per cent War Savings Bonds subscriptions under the payroll deduction plan. Special mention is made of the methods used on the Boston & Maine, the first railroad with more than 300 employees to report subscriptions amounting to 10 per cent of the payroll. Daily reports were required from each sub-committee. This made it possible to send out system reports so that each craft and each division could currently compare its record with others. Stragglers and employees at outlying points whose duties made it difficult for them to attend meetings were rounded up by using a motor track inspection car.

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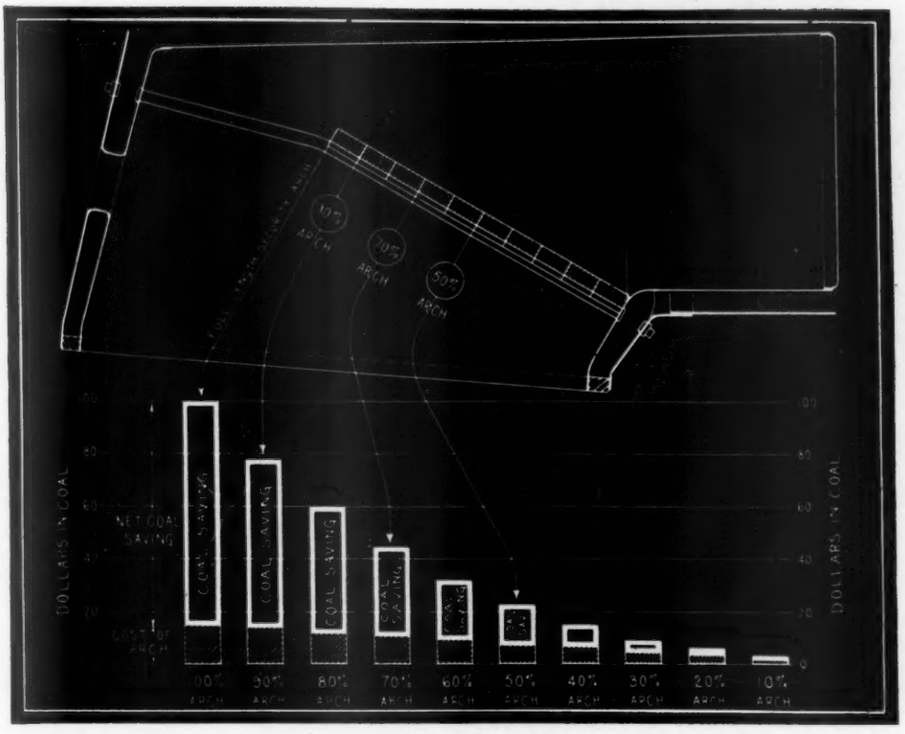

THE EFFECT OF ABBREVIATED ARCHES ON FUEL SAVING

FUEL CONSERVATION... a wartime need!

Fuel wastage is a two-fold loss; the fuel itself and the transportation necessary to haul it. Because of the strategic importance of fuel to the war program every effort must be made to conserve this vital material.

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You need a full Arch for full fuel economy.

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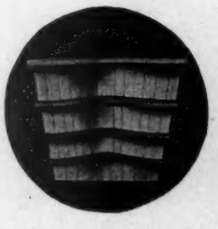

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Among the Clubs and Associations

NORTHWEST CAR MEN'S ASSOCIATION.—Meeting held November 2. Speaker: A. T. Cox, Jr., Lincoln Electric Railway Sales Co., Chicago. Subject: Electric arc welding and its value to the railroads.

EASTERN CAR FOREMEN'S ASSOCIATION.—Meeting 8 p. m., November 13, 29 West Thirty-ninth street, New York. Speaker: James A. Shafer, National Malleable & Steel Castings Company, Cleveland, Ohio. Subject: High-Speed Freight-Car Trucks.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—At the annual meeting and smoker of the Car Foremen's Association of Chicago on Monday evening, October 12, the following officers were elected to direct the activities of the association during the coming year: President, H. B. Atherton, car foreman, Chicago Great Western, Chicago; first vice-president, W. J. Burns, mechanical inspector, General American Transportation Corporation, Chicago; second vice-president, J. Krupka, car foreman, Chicago, Burlington & Quincy, Chicago. G. K. Oliver, assistant passenger car foreman, Baltimore & Ohio Chicago Terminal, was re-elected secretary and C. J. Nelson, superintendent, Chicago Car Interchange Bureau, was re-elected treasurer.

A. S. M. E. Annual Meeting

WAR production and man power are the main topics for discussion at the sixty-third annual meeting of the American Society of Mechanical Engineers to be held at the Hotel Astor, New York, November 30 to December 4. "Planned Conservation of Railroad Mechanical Manpower" is the theme of the Railroad Division sessions, at which the Hon. Paul V. McNutt, chairman, War Manpower Commission, Washington, D. C., will be a speaker. A report on Diesel locomotive progress under war conditions has also been prepared for presentation at a joint session of the Oil and Gas Power and Railroad Divisions. The programs for these sessions, also the session on Mechanical Springs, are as follows:

Wednesday, December 2

2 p. m.

OIL AND GAS POWER—RAILROAD

Diesel Locomotive Progress Report Under War Conditions

Speakers:

Paul Turner, eastern regional manager, Electro Motive Corporation.

Max Essl, chief engineer, Diesel Division, Baldwin Locomotive Works.

P. H. Hatch, assistant mechanical engineer, New York, New Haven & Hartford.

Wayne E. Lynch, American Locomotive Company, and General Electric Company.

W. S. H. Hamilton, equipment electrical engineer, New York Central System.

A. K. Galloway, general superintendent motive power and equipment, Baltimore & Ohio.

Progress Report on Gas Turbine Locomotive Operation, by Paul R. Sidler, resident engineer, Brown, Boveri & Co., Ltd.

Future Diesel Locomotive Possibilities, by P. B. Jackson, Aluminum Company of America.

7 p. m.

A. S. M. E. banquet.

Thursday, December 3

9:30 a. m.

RAILROAD—I

Planned Conservation of Railroad Mechanical Manpower

Speakers:

Hon. Paul V. McNutt, chairman, War Manpower Commission, Washington, D. C.

F. K. Mitchell, assistant general superintendent motive power and rolling stock, New York Central.

Otto S. Beyer, chief, Personnel Section, Office Defense Transportation.

Dr. A. C. Willard, president, University of Illinois.

Col. Jas. L. Walsh, chairman, War Production Committee, A. S. M. E.

12:30 p. m.

Luncheon.

2 p. m.

RAILROAD—II

Planned Conservation of Railroad Mechanical Manpower (Continued)

Speakers:

Harold V. Coes, president, A. S. M. E.

Dorothy Sells, assistant chief, Personnel Section, Office Defense Transportation.

Charles E. Brinley, president, Baldwin Locomotive Works.

Brig. Gen. Julian S. Hatcher, chief, Military Training Branch, Ordnance Dept., United States Army.

Discussion by leading governmental, railroad, and industrial executives.

MECHANICAL SPRINGS

Volute-Spring Formulas, by C. J. Holland, president, Holland Co., Chicago.

The Testing of Volute Springs, by Bernhard Sterne, experimental engineer, Chrysler Corporation, Detroit, Mich.

Notes on Secondary Stresses in Volute Springs, by Henry O. Fuchs, engineer, General Motors Corporation, Detroit, Mich.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

ALLIED RAILWAY SUPPLY ASSOCIATION.—J. F. Gettrust, P. O. Box 5522, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York. Annual meeting Hotel Astor, New York, December 1-5.

RAILROAD DIVISION.—E. L. Woodward, *Railway Mechanical Engineer*, 105 West Adams street, Chicago.

ANTHRACITE VALLEY CAR FOREMEN'S ASSN.—Victor H. Deppe, general secretary, Mountain Top, Pa. Meets third Monday of each month at Wilkes-Barre, Pa.

ASSOCIATION OF AMERICAN RAILROADS.—Charles H. Buford, vice-president Operations and Maintenance Department, Transportation Building, Washington, D. C.

OPERATING SECTION.—J. C. Caviston, 30 Vesey street, New York.

MECHANICAL DIVISION.—A. C. Browning, 59 East Van Buren street, Chicago.

PURCHASES AND STORES DIVISION.—W. J. Farrell, Executive Vice Chairman, Transportation Building, Washington, D. C.

MOTOR TRANSPORT DIVISION.—George M. Campbell, Transportation Building, Washington, D. C.

CANADIAN RAILWAY CLUB.—C. R. Crook, 4415 Marcil avenue, N. D. G., Montreal, Que. Regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS.—J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—Frank Kartheiser, chief clerk, Mechanical Dept. C. B. & Q., Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 8238 S. Campbell avenue, Chicago, Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1840-2, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION.—W. P. Dizard, 30 Church street, New York. Regular meetings, second Friday of January, February (annual dinner), March, April, May, October, and November at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—H. T. Bramblett, care of H. P. Ruck, car foreman, Pennsylvania, 764 South Emerson avenue, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, in Indianapolis Union Station, Indianapolis, at 7 p. m.

LOCOMOTIVE MAINTENANCE OFFICERS' ASSOCIATION.—Secretary-treasurer C. M. Lipscomb, Missouri Pacific, North Little Rock, Ark.

MASTER BOILER MAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MIDWEST AIR BRAKE CLUB.—C. F. Davidson, secretary-treasurer, general inspector car department, St. L.-S. F., Springfield, Mo.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings second Tuesday in each month, except June, July, August and September, at Hotel Touraine, Boston, Mass.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

NORTHWEST LOCOMOTIVE ASSOCIATION.—G. T. Gardell, 820 North Pacific Building, St. Paul, Minn. Meetings third Monday of each month, except June, July and August.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box A, Sausalito, Calif. Regular meetings, second Thursday of each alternate month at Palace Hotel, San Francisco, Calif., and Hotel Hayward, Los Angeles.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 308 Keenan Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, Room 811, Utilities Building, 327 South La Salle street, Chicago.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 308 Keenan Building, Pittsburgh, Pa.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, 4 Hunter St., S. E., Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July, and August at Royal York Hotel, Toronto.

WESTERN RAILWAY CLUB.—E. E. Thulin, executive secretary, 122 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August, September, and January, Hotel Sherman.

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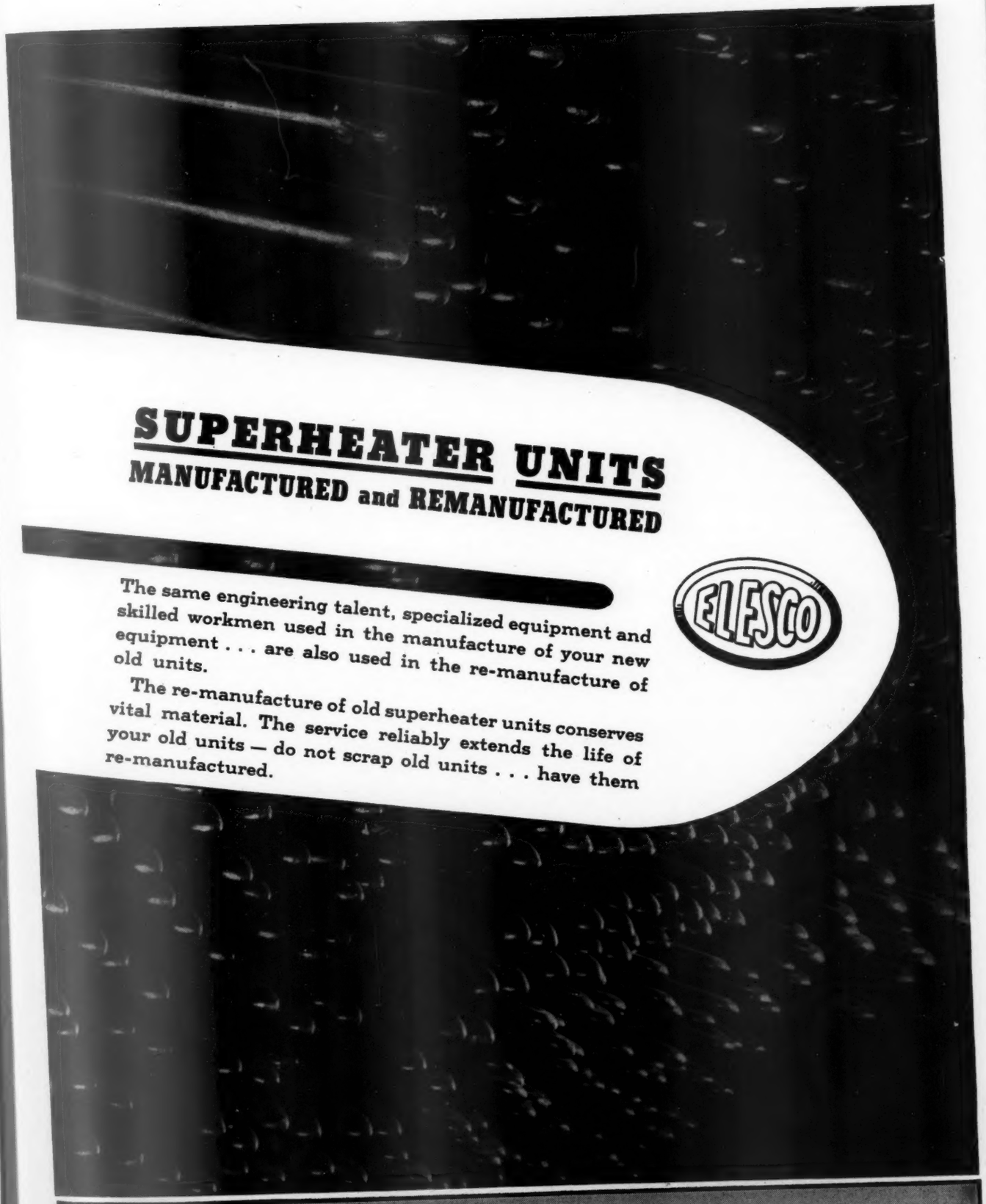

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NEWS

Mechanical Division, A. A. R.

Letter Ballot Results

As a result of a favorable letter ballot, 11 specific recommendations for changes in the standards and recommended practices of the A. A. R. have been approved effective immediately. These recommendations include the following proposals: (1) to modify the braking ratio for freight cars; (2) to increase the dimension defining the maximum height of steam heat couplers above the center line, as shown on page E-78-1942 of the Manual; (3) to adopt new specifications M-914-brake cylinder lubricant; (4) to advance to standard the present recommended practice testing device for air brake hose couplings and instructions for its use, and make same mandatory for use in testing hose couplers before being mounted on hose; (5) to modify autogenous welding limits and regulations; (6) to modify the specifications for geared hand brakes; (7) to revise recommended practice designs of lightweight pistons; (8) to adopt standard brake shoes and wheels for use on Diesel-electric switching locomotives; (9) to modify Sec. 10(a) of the standard method of packing journal boxes; (10) to revise definitions and designating letters for tank cars; (11) to revise Sec. VI—marking of specifications M-123-41.

The first four propositions were advanced by the Committee on Brakes and Brake Equipment; Nos. 7 and 8 by the Committee on Locomotive Construction and each of the others by the particular committee interested. All propositions were approved by the General committee before being submitted to letter ballot in a circular dated September 5, 1942.

Inspection of New Cast-Iron Wheels

In a circular letter, recently issued by the Division, attention is called to A. A. R. Specification M-403-41 which covers cast-iron wheels for locomotives, tenders and cars, and provides that "In all cases where wheels are rejected for any reason, the letter 'R' must be chipped out of the 'A. A. R.'" With the modification in wheel markings recently placed in effect, which eliminates the purchaser's name, the above requirements assume increasing importance. The circular letter emphasizes the necessity of insisting that the letter "R" be chipped from rejected wheels in the presence of inspectors at the time of rejection, with the understanding that any violation of the requirement must be reported to the office of the secretary of the Mechanical Division. The purchaser's inspectors are held responsible for policing this provision.

Safety Support Rule Extended

The Division has recently taken action to extend by one year the effective date of Interchange Rule 3, Sec. (b), Par. (8), which provides that effective January 1, 1943, cars will not be accepted from the owner unless equipped with bottom-rod and brake-beam safety supports, A. A. R. recommended practice, or A. A. R. approved equivalent; and that, effective July 1, 1943, this provision will become a general interchange requirement. The Board of Directors of the association has given consideration to this rule and decided to extend the effective date for one year to January 1, 1944, with the understanding that car owners will co-operate to the end that all of their interchange freight cars will be fully equipped by that date.

ODT Appointments

H. S. Keppelman, superintendent car department of the Reading, with headquarters at Reading, Pa., has been granted a leave of absence to accept appointment as deputy associate in charge of freight and passenger car repairs of the Division of Railway Transport, Office of Defense Transportation.

J. E. Friend, master mechanic of the Western division of the Texas & Pacific at Ft. Worth, Tex., has been granted a leave of absence to serve as assistant to associate director, Office of Defense Transportation.

Equipment Purchasing and Modernization Programs

Canadian National.—A contract amounting to more than $20,000 has been awarded P. W. Graham & Sons, Moose Jaw, Sask., for reroofing 12 stalls, lengthening six stalls, and lengthening the engine pits in three stalls of the enginehouse at Biggar, Sask.

Delaware & Hudson.—The Delaware & Hudson has awarded a contract for extending 13 stalls of its enginehouse at Oneonta, N. Y., at an estimated cost of $60,000, to the Oneonta Contracting Company.

Erie.—The Erie has authorized the construction of a coupler repair shop at the scrap reclamation plant, Meadville, Pa., at a cost of approximately $20,000.

Grand Trunk Western.—Company forces are engaged in work at the car shops of the Grand Trunk Western at Port Huron, Mich., which will cost approximately $39,000. The work consists of the removal of a timber roof and monitors, including timber posts, and replacement with a new timber roof supported on second-hand steel roof trusses. The new construction will provide a clear span of 80 ft. between exterior walls for a length of 360 ft. adjoining the new steel freight car shop rebuilt in 1935.

The Missouri Pacific.—The Missouri Pacific has been authorized by the District Court to recondition 50 steel box cars for use as baggage cars for troop movements.

New York Central.—This company has awarded a contract for the reconstruction of stalls 11 to 22 of its enginehouse at Gardenville, N. Y., to the John W. Cowper Co., Inc., of Buffalo, N. Y.

New York, New Haven & Hartford.—The Interstate Commerce Commission, Division 4, has authorized the N. Y., N. H. & H. to assume liability for $1,390,000 of two per cent equipment trust certificates to be sold at 98.559 per cent of par and accrued dividends to Halsey, Stuart & Company, Inc. The certificates will mature in 10 equal annual installments of $139,000 each on October 1 of each year from 1943 to 1952, and the proceeds will be used to finance in part the acquisition of ten 2,000-hp. Diesel-electric "A" unit passenger and freight locomotives, costing an estimated total $1,738,940.

Texas Mexican.—This road is constructing an engine house and shop 40 ft. by 100 ft. by 22 ft. high, of concrete and second hand brick at Corpus Christi, Tex. The enginehouse will have a drop pit and will be equipped to make light repairs.

Union Pacific.—The Union Pacific has awarded a contract amounting to about $31,000 to the F. W. Miller Heating Company for the installation of direct steaming equipment in the enginehouse at Green River, Wyo. The work covers the installation of special heat exchangers and necessary pipe in the blowdown and fill-up lines, using live steam from the power plant to raise the temperature of fill-up water to 230 to 340 deg. F., depending upon the velocity of the water supply and the pressure of steam.

Wabash.—This company has asked the Interstate Commerce Commission for authority to assume liability for the $2,000,000 equipment trust certificates mentioned in the September *Railway Mechanical Engineer,* page 402, the proceeds of the issue to be used as a part of the purchase price of the equipment therein mentioned.

The Western Pacific.—The Western Pacific has received authorization from the United States district court at San Francisco, Calif., for the purchase of nine locomotives, to help haul the railroad's heavy war load, at an approximate cost of $2,800,000. Three of the new motive power units will be Diesel-electric main-line engines of 5,400 hp. each, to be built by the Electro-Motive Corporation at cost of $506,350 each, or a total of $1,519,050. The remaining six will be steam freight locomotives of 4-8-4 wheel arrangement, to be built by the Lima Locomotive Works at cost of $210,530 each, or a total of $1,263,180. Delivery of the new locomotive power is expected during the first six months of 1943. The railroad's application for purchase authority stated that funds on hand would be used to make an initial payment of $695,558 or 25 per cent of the total cost, with the balance to be covered by the sale of equipment notes.

"Movie" Shows Turret-Lathe Operation

THE Gisholt Machine Company, Madison, Wis., has completed a sound and color motion picture, "Turret Lathes—Their Operation and Use," which is designed to aid in training new machine shop employees. The subject matter covered includes a comparison of the turret lathe with other metal-working machines and detailed sequences illustrating the basic types of work done on a turret lathe and the production methods followed in each case. The film is of the 16 mm. size.

Railway and Supply Men Win Welding Awards

TWENTY-TWO engineers, designers, supervisors and welders of railroads and supply companies are the winners of 18 awards in the $200,000 Industrial Progress Award Program which the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, has been conducting during the last 2½ years. All together 408 awards were made to 458 recipients who submitted reports of welding progess.

Some of the winners of awards in the field of railway motive power and rolling stock, the amounts, and the subjects of their papers are as follows:

J. E. Candlin, Jr., assistant engineer and A. M. Unger, plant engineer, of the Pullman-Standard Car Manufacturing Company, Chicago, $3,700. Major consideration in the applications of welding to railroad passenger cars since 1936.

H. Malcolm Priest, engineer of the U. S. Steel Corporation subsidiaries, Pittsburgh, Pa., $2,700. Welding 250-ton flat cars.

John H. Hruska, chief inspector of the Electro-Motive Division of General Motors Corporation, La Grange, Ill., $1,700. Problems in the construction of an all-welded 5,400 H. P. Diesel-electric freight locomotive.

John F. Muller, sales engineer and Gonzalo C. Munoz, secretary-treasurer, of the American Pulley Company, Philadelphia, Pa., $1,300. A method of suspending the compressor of a railroad car air-conditioning system.

Cyril Henry Easun, assistant mechanical engineer, Shop Methods, Central region of the Canadian National, Toronto, Ont., $700. Tire failures on fast passenger and freight locomotives.

Paul E. McKamy, industrial locomotive designer of the Whitcomb Locomotive Company, Rochelle, Ill., $500. The substitution of an all-welded locomotive truck frame for a steel casting.

John Dewar Seivewright, welding supervisor of the Central region of the Canadian National, Toronto, Ont., $500. Railroad brake shoe castings.

Carl Ray Averitt, assistant blacksmith foreman of the Illinois Central, Paducah Shops, Paducah, Ky., $500. Fabrication of a steam locomotive cylinder.

Walter E. Barron, foreman in charge of welding of the Heisler Locomotive Works, Erie Pa., $250. The construction of a "fireless" locomotive.

Clifford A. Salk, carman and Ray F. Theisen, welder of the Great Northern, St. Cloud Shops, St. Cloud, Minn., $250. The conversion of tenders into tank cars.

John P. Roger, plant engineer of the Babcock and Wilcox Company, Barberton, Ohio, $150. Welding applications to parts of a locomotive boiler.

Jesse F. Holloway, designer of the Car, Truck and Diesel Locomotive division of the Baldwin Locomotive Works, Eddystone, Pa., $100.

J. J. Laudig, research engineer of the Delaware, Lackawanna & Western, Scranton, Pa., $100.

Supply Trade Notes

D. L. IMMEL has been promoted to assistant plant superintendent at the Warren, Ohio, plant of the Copperweld Steel Company.

◆

TUBULAR PRODUCTS, INC., a subsidiary of the United States Steel Corporation, has changed its name to Tubular Alloy Steel Corporation to "more truly reflect the emphasis which will be given to the production of tubular alloy steel products."

◆

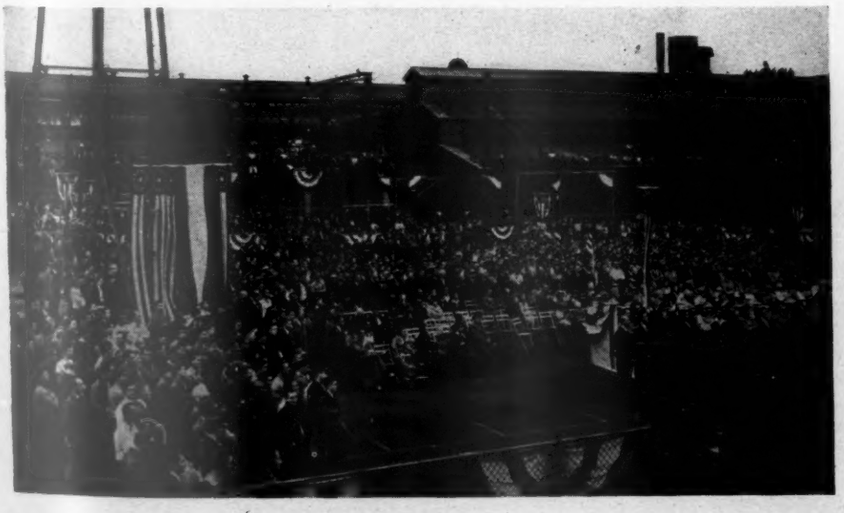
R. L. SALTER, engineer of tests of the Association of Manufacturers of Chilled Car Wheels, with headquarters at Chicago, has resigned to enter the employ of the Southern Wheel division of the American Brake Shoe & Foundry Co., at New York.

METAL & THERMIT CORPORATION.—*Merritt L. Smith,* advertising manager of the Metal & Thermit Corporation, has been appointed also assistant sales manager, with headquarters at 120 Broadway, New York. *Charles D. Young,* formerly district manager at Chicago, has been appointed sales manager of the welding division, with headquarters at New York.

◆

WHITING CORPORATION.—*Howard D. Grant,* executive vice-president of the Whiting Corporation, Harvey, Ill., has been elected president to succeed *Thomas S. Hammond,* who is now in charge of the Chicago district ordnance staff and has been succeeded by *Stevens H. Hammond,* vice-president, as executive vice-president and chief of the executive staff.

* * *



Employees of the Bullard Company gathered at Bridgeport, Conn., on October 13 to present to the U. S. Army Air Forces a Republic P-47 fighting plane—"The Bullard Thunderbolt"—the fund for which they had collected among themselves

E. P. BARRY has been appointed co-ordinator of plants of the Chicago Pneumatic Tool Company. Mr. Barry will supervise machine equipment, tool designing, and production methods for the company's plants at Detroit, Mich.; Cleveland, Ohio, Franklin, Pa., and Garfield, N. J.

◆

PITTSBURGH STEEL COMPANY.—*Henry A. Roemer, Jr.,* formerly manager of sales of steel and wire products for the Pittsburgh Steel Company, has been appointed assistant general manager of sales. *Norman F. Melville,* formerly assistant manager of sales of steel and wire products, has been appointed manager of sales of that department to succeed Mr. Roemer.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—In the interest of furthering the war effort, the Carnegie-Illinois Steel Corporation, a subsidiary of the United States Steel Corporation, has announced a program of cash awards for suggestions advanced by employees, which result in furthering production. The program is being conducted by the various war-production drive committees established in each of the Carnegie-Illinois plants. Suggestions boxes have been provided by the committees throughout the mills and offices into which all suggestions are to be deposited. For each suggestion accepted, the employee will receive an award of $10.

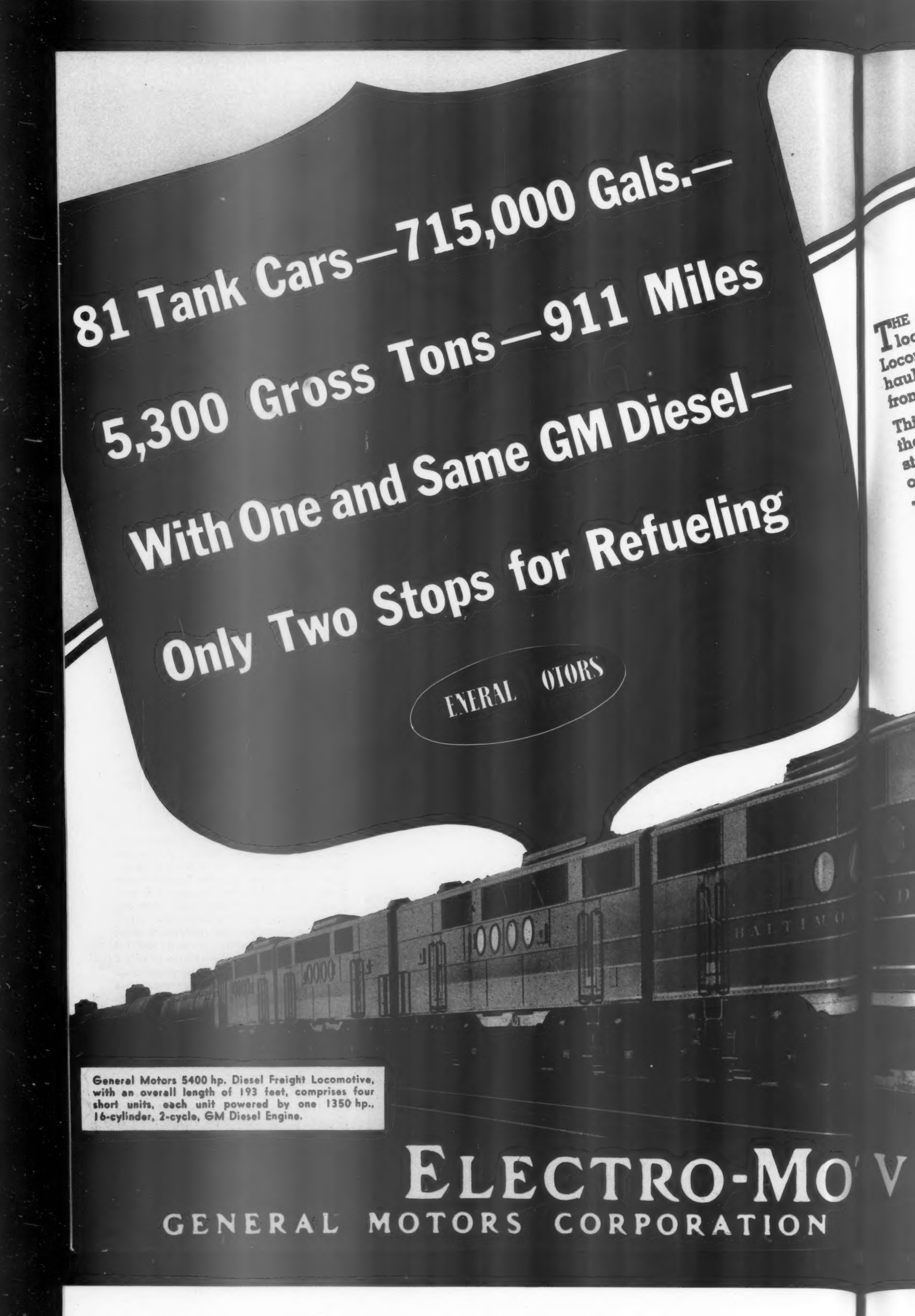
◆

GEORGE M. COOPER has been transferred to the western sales department of the Brake Shoe and Castings and Wheel division of the American Brake Shoe & Foundry Co., with headquarters at Houston, Texas. He began his career with the American Brake Shoe & Foundry Co. in

(*Continued on second left-hand page*)

81 Tank Cars—715,000 Gals.—
5,300 Gross Tons—911 Miles
With One and Same GM Diesel—
Only Two Stops for Refueling

ENERAL OTORS



General Motors 5400 hp. Diesel Freight Locomotive, with an overall length of 193 feet, comprises four short units, each unit powered by one 1350 hp., 16-cylinder, 2-cycle, GM Diesel Engine.

ELECTRO-MO V

GENERAL MOTORS CORPORATION

B&O

THE Baltimore and Ohio, the first eastern railroad to adopt Diesel passenger locomotives, has again made history. One of their new 5400 Hp. Diesel Freight Locomotives, built by Electro-Motive Division of General Motors Corporation, hauled a solid train of 81 tank cars of oil — 715,000 gallons — 5300 gross tons — from Chicago to Twin Oaks (Philadelphia), Pa.

This was one of the heaviest single through-rail shipments of oil on record and the entire run of 911 miles was made with one and the same locomotive. Five stops were made for customary crew changes and inspections, but at only two of these stops was it necessary to refuel the locomotive.

These new GM Diesels will permit the release of a considerably larger number of heavy steam locomotives for other important services. This is another outstanding example of how GM Diesels make it possible for the railroads to meet war demands for increased motive power and with savings of more than 50 per-cent in critical materials — because one ton of materials in a GM Diesel will do the work of more than two tons of materials in a steam locomotive. Conservation is vital to VICTORY and—

VICTORY IS OUR BUSINESS

O'VE DIVISION

LA GRANGE, ILLINOIS, U. S. A.

1918 as an office boy in the Ramapo Iron Works, now a part of the Ramapo Ajax division. From January, 1921, to December, 1922, he was secretary to the president of the Ramapo company. In December, 1922, he was transferred to the export department, where he served until April, 1925. Mr. Cooper was then transferred to the sales department, where he remained until his recent transfer.

◆

CHARLES RIDDELL.—The Baldwin Locomotive Works and subsidiary companies had 100 guests, principally railroad and railway supply men, at a dinner at the Chicago Club in Chicago on the evening of October 12 to do honor to Charles Riddell, district manager at Chicago of these companies, in celebration of his completion of 60 years in their service. Charles E. Brinley, president of Baldwin, presided.

Mr. Riddell entered the service of the Standard Steel Works, a subsidiary of Baldwin, as an office boy in Philadelphia on October 12, 1882, when 15 years old. From 1896 to 1904 he was Chicago manager of the Standard Steel Works, and since 1904 has been district manager of Baldwin and all subsidiaries. He is still in vigorous health, and Mr. Brinley announced that he will continue as district manager.

◆

GEORGE J. WEBER, secretary and executive assistant to the president of the Association of Manufacturers of Chilled Car Wheels, has been appointed engineer of tests, with headquarters at Chicago. Mr.

George J. Weber

Weber entered the employ of the Griffin Wheel Company in 1905 and served as chief inspector and a member of the general operating staff for specialized services, including the operation of foundries. He joined the staff of the Association of Manufacturers of Chilled Car Wheels as secretary in 1934 and in 1936 became also executive assistant to the president.

◆

CHARLES H. MCCREA, who has been elected president of the National Malleable and Steel Castings Company, as noted in the October issue, is 52 years of age. He was graduated from Purdue University with a degree in civil engineering in 1912 and began his business career in the engineering department of the Pennsylvania during college vacations and for three months after graduation. He was employed in the construction department of the Erie from September, 1912, to February, 1913, when he joined the National Malleable and Steel Castings Company as a special engineer in the Toledo, Ohio, works. From September, 1914, to April, 1916, he was a service engineer in the company's Cleveland, Ohio, Sharon, Pa., and Chicago offices and from April, 1916, to June, 1917, was a salesman at the St. Louis, Mo., office. He served as a captain in the United States army from June, 1917, to January, 1920, when he returned to the National Malleable and Steel Castings Company as manager of the St.

Charles H. McCrea

Louis office. From June, 1922, to October, 1923, he was engaged in sales work in Germany, France, Belgium, England, India, New Zealand and Australia. Mr. McCrea was appointed manager of the St. Louis office in October, 1923, sales manager of the Cleveland works in January, 1931, and manager of the Cleveland works in January, 1938. He became first vice-president and director of the company in May, 1942.

Army-Navy Production Awards

American Brake Shoe and Foundry Co., American Forge division. October 24.

American Rolling Mill Company, Middletown, Ohio. All divisions. October 5.

Edgewater Steel Company, Oakmont, Pa. October 1.

The Ex-Cell-O Corporation, Detroit, Mich. September 11.

The Flannery Bolt Company, Bridgeville, Pa. October 9.

General Steel Castings Corporation, Granite City, Ill., and Eddystone, Pa. October 1.

Independent Pneumatic Tool Company, Aurora, Ill. October 8.

The International Nickel Company, Huntington, W. Va. Awarded for third time.

Revere Copper and Brass, Inc., Dallas division, Chicago. October 7.

Timken-Detroit Axle Company, Detroit, Mich.; Waukegan, Ill.; Oshkosh, Wis. September 10 and 12.

Westinghouse Electric & Manufacturing Co. Five plants in Pittsburgh, Pa., area.

Obituary

ROY HUNTER, direct sales representative in the northern Ohio and western Pennsylvania area for the Gisholt Machine Company, Madison, Wis., died September 12 at the age of 54.

◆

FRANK E. BLANCHARD, sales engineer in the engine department of the Caterpillar Tractor Company, Peoria, Ill., died suddenly at Peoria on September 14. He was 54 years of age.

◆

C. D. HILFERTY, who retired in March, 1941, as librarian and special research engineer of the Superheater Company, died on September 26. Mr. Hilferty was 73 years of age. He had served as head draftsman at the Schenectady, N. Y., plant of the American Locomotive Company, where he designed the first locomotive piston valve, and later was employed on the Michigan Central. He was also formerly with Cooke Works in Paterson, N. Y., as resident inspector, and for three years was chief inspector at a plant of the American British Manufacturing Company in Bridgeport, Conn. He joined the Superheater Company in November, 1910, and after serving for five years as service engineer was transferred to engineering duties in the New York office. From 1921 until his retirement in 1941, he was librarian and special research engineer.

◆

GEORGE C. ISBESTER, railroad sales manager of the Yale & Towne Mfg. Company,

George C. Isbester

died on October 10. Mr. Isbester was born at Niagara Falls, N. Y., on June 9, 1878. He entered the railway field in 1899 in the mechanical department of the Great Northern and from 1908 to 1913 was in charge of the Chicago office of the Q. & C. Co. In 1917 he entered the Navy as a captain. He served as aide to Admiral Moffett at Great Lakes, Ill., and later to Admiral Sims at London, England. After the war, he was associated with the American Chain Company and the Brown-Isbester Company. In 1933, he became railroad sales manager of Yale & Towne Mfg. Co.

ALBERT E, CRONE, vice-president and general manager, with headquarters at Lackawanna, N. Y., for the Buffalo Brake Beam Company of New York, died in Buffalo, N. Y., on October 18. He was 70 years of age.

◆

R. W. BURNETT, president of the Ajax Hand Brake Company, Chicago, died in that city on October 13. Mr. Burnett was born at Farmer City, Ill., in 1868 and entered railway service in 1890 in the car department of the Union Pacific at Denver, Colo. In 1892, he entered the employ of the Pennsylvania as a car inspector at Chicago, and from August, 1892, to July, 1899, was successively foreman and general foreman of the car department of the Lake Shore & Michigan Southern (now N. Y. C.) at Chicago. During the early part of 1900 he was general foreman of the car department of the Long Island, and in the latter part of the year was general foreman of the car department of the Central of New Jersey at Elizabeth, N. J. From 1904 to January, 1907, he was successively assistant master car builder and master car builder of the Erie at Meadville, Pa. On the latter date he became assistant master car builder of the Canadian Pacific. He was appointed general master car builder in 1909 and resigned in 1915 to become vice-president of the National Car Equipment Company. He returned to railway service on September 1, 1917, as master car builder of the Delaware & Hudson and in 1919 resigned to become assistant to the general manager of the Joliet Railway Supply Company and vice-president of the National Car Equipment Company, with headquarters at Chicago. In 1926, he became president of the Ajax Hand Brake Company.

R. W. Burnett

Personal Mention

General

R. E. LEE has been appointed assistant mechanical engineer of the Seaboard Air Line at Norfolk, Va.

A. J. FERENTZ, superintendent car department of the Lehigh Valley at Bethlehem, Pa., has been appointed assistant superintendent at Wilkes-Barre, Pa.

EDWARD H. ROY, night enginehouse foreman of the Norfolk Southern at Raleigh, N. C., has been appointed chief mechanical inspector, with headquarters at Norfolk, Va.

J. P. STEWART, general supervisor of air brakes of the Missouri Pacific at St. Louis, Mo., retired on September 30.

W. R. SUGG, superintendent of fuel conservation and lubrication of the Missouri Pacific, with headquarters at St. Louis, Mo., has been appointed general supervisor of air brakes at St. Louis.

J. J. FREIBOLT, road foreman of engines of the Missouri Pacific at No. Little Rock, Ark., has been appointed superintendent of fuel conservation and lubrication at St. Louis, Mo.

A. E. RICE, assistant superintendent of the Pueblo division of the Denver & Rio Grande Western at Pueblo, Colo., has been appointed assistant to the chief mechanical officer, with headquarters at Denver, Colo.

JOHN R. GROVE, assistant superintendent motive power of the Lehigh Valley, with headquarters at Bethlehem, Pa., has been appointed superintendent motive power, with headquarters at Bethlehem.

J. W. WOMBLE has been appointed to fill the newly created position of assistant to vice-president (mechanical) of the Midland Valley, the Kansas, Oklahoma & Gulf and the Oklahoma City-Ada-Atoka, with headquarters at Muskogee, Okla.

MICHAEL A. SMITH, general manager of the Pittsburgh & Lake Erie at Pittsburgh, Pa., retired on October 1. Mr. Smith was born at Norwalk, Ohio, on September 7, 1872, and was educated in the public schools of Norwalk. He entered the service of the Wheeling & Lake Erie as a locomotive fireman on August 29, 1890, and became locomotive engineer in 1896. Mr. Smith left the Wheeling & Lake Erie in 1899 and in March, 1900, entered the service of the Pittsburgh & Lake Erie as a locomotive inspector, and served in that capacity until June, 1901. From the latter date until November, 1902, he was traveling fireman, and later enginehouse foreman. In June, 1904, Mr. Smith became general foreman at the Glassport shops, and in December, 1912, was transferred to the East Youngstown shops. In September, 1917, he became trainmaster and in June, 1923, assistant superintendent of motive power. Mr. Smith was appointed superintendent of motive power in September, 1927, and general manager in November, 1930.

Michael A. Smith

D. S. NEUHART, master mechanic of the Union Pacific at Los Angeles, Calif., has been appointed superintendent of motive power and machinery, with headquarters at Omaha, Neb.

F. E. MOLLOY, master mechanic of the San Joaquin division of the Southern Pacific at Bakersfield, Calif., has been appointed assistant superintendent of motive power, with headquarters at Los Angeles, Calif.

JOHN ROBERTS, chief of motive power and car equipment of the Canadian National, and managing director of National Railways Munitions, Limited, with headquarters at Montreal, Que., is now devoting his entire time to the direction of the big munitions plant operated by the National system.

JOHN P. LAUX, superintendent motive power of the Lehigh Valley at Sayre, Pa., has been appointed assistant to vice-president and general manager, with headquarters at Bethlehem, Pa. Mr. Laux was born at Pittston, Pa., on July 17, 1882, and attended Pennsylvania State College. He entered railroad service on September 10, 1898, with the Lehigh Valley and served until July 11, 1900, as crew caller and crew dispatcher at Sayre, Pa. He then served successively as machinist apprentice and air brake inspector at Sayre before going with the Southern as foreman at Knoxville, Tenn. In October, 1909, Mr. Laux returned to the Lehigh Valley as foreman at Sayre, then serving successively as general foreman at Manchester, N. Y.; assistant master mechanic at South Easton, Pa., and master mechanic at Hazleton, Pa., Sayre, and South Easton, successively. On June 1, 1923, Mr. Laux became shop superintendent at Sayre and on February 15, 1929, he was appointed superintendent motive power at Bethlehem, being transferred to Sayre on July 1, 1938.

(Turn to second left-hand page)

TEN MORE

10 BUILT IN 1937

5 BUILT IN 1938

7 BUILT IN 1941

10 BUILT IN 1942

DELIVERED

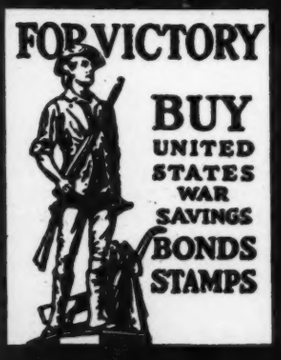
ARMY E NAVY

Another 100% War Job

Drawing iron ore south from Lake Erie and steel and coal north from the Pittsburgh district is one of the Nation's most important war-time hauling tasks. American Locomotive Company delivered ten locomotives to the Wheeling and Lake Erie Railway in 1937 for this service, five in 1938, seven in 1941.

This year, while also breaking production records and keeping ahead of commitments on tanks, gun carriages and other important ordnance, American Locomotive Company delivered ten more of these locomotives. How? The designs were already made, so were the tools and jigs.

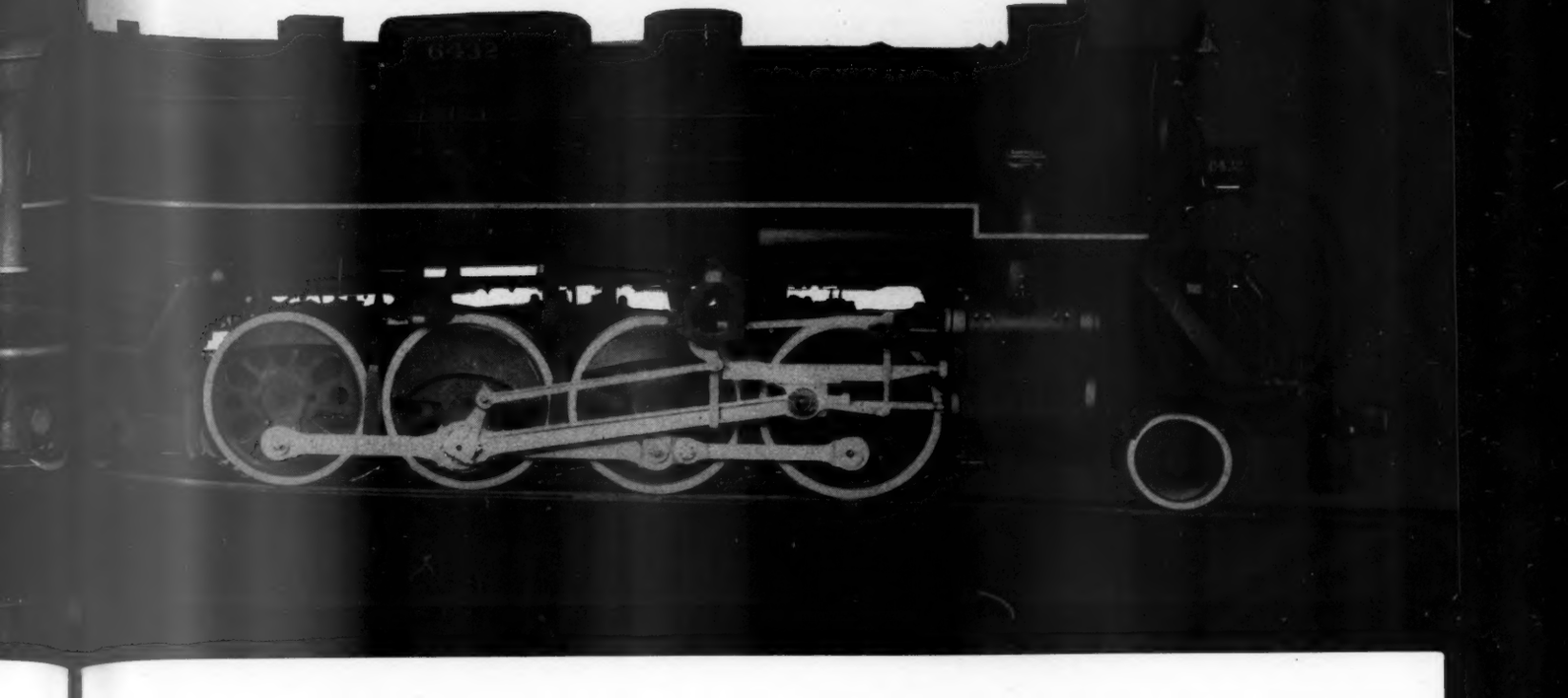
With this fleet of thirty-two modern, high-speed, freight locomotives strengthening their motive power, the Wheeling and Lake Erie Railway is enviably equipped to handle their enormous task.



AMERICAN LOCOMOTIVE

Manufacturers of Mobile Power

Steam, Diesel and Electric Locomotives, Marine Diesels, Tanks, Gun Carriages and other Ordnance



W. C. SEALY, superintendent of the motive-power and car shops of the Canadian National at Montreal, Que., has been appointed general superintendent of motive power and car equipment, with headquarters at Toronto, Ont. Mr. Sealy entered railway service with the Canadian National as a messenger in the shops at Stratford, Ont., in May, 1903. A year later he became apprentice mechanic, terminating his apprenticeship in June, 1908. In November, 1909, he was appointed erecting shop foreman, and in 1910, general foreman at Toronto. Subsequently he was appointed assistant master mechanic, and in November, 1915, became master mechanic. During 1917 Mr. Sealy's services were loaned to the General Car and Machinery Company, and he was employed at Montmagny, Que., as an instructor in the installation of a shell-manufacturing plant. He returned to Stratford in September, 1917, as foreman during a period when that shop was also engaged in the manufacture of shells for the British Army. In 1921, he became general foreman at Stratford, and in October, 1928, was appointed acting superintendent of the motive-power shop, becoming superintendent of the motive-power shop in January, 1929. In February, 1939, Mr. Sealy was appointed superintendent of motive-power and car shops at Montreal.

W. C. Sealy

EDWIN ROY BATTLEY, general superintendent of motive power and car equipment of the Canadian National at Toronto, Ont., has been appointed chief of motive power and car equipment, with headquarters at Montreal, Que. Mr. Battley was born on October 21, 1886, at Stratford, Ont. He entered railway service in December, 1902, at Stratford, as a stenographer in charge of the office work for the locomotive foreman in the enginehouse of the Grand Trunk (now Canadian National), later becoming a "caller" for locomotive crews. After a short time, he was transferred to the enginehouse to learn the details of grooming engines, after which he went to work in the motive-power shops and progressed through all phases of apprenticeship to qualify as a machinist in 1908. His first supervisory position was that of inspector at Stratford and his next that of locomotive foreman at Fort Erie. In 1914, he became general foreman of the shops at Deering, Me.; in 1917, master mechanic at Montreal, and in 1918, superintendent at Montreal. In 1927, when the union-management co-operative committees were being developed on the Canadian National, Mr. Battley was the machinist member of the committee of experts organized by the company's Bureau of Economics to study the technical features of the plan which has proved successful in actual operation. From Montreal Mr. Battley was transferred to the Toronto shops, and in July, 1930, was given a leave of absence to work with the National Railways of Mexico in conducting a study of machine shops and preparing recommendations for these establishments. Returning to Canada from Mexico, Mr. Battley was appointed superintendent of shop methods, with headquarters in Montreal, and in April, 1933, was promoted to the position of general superintendent of motive power and car equipment at Toronto. In addition to his other duties, Mr. Battley will be in charge of the System shops in Canada and the United States.

Edwin Roy Battley

FRANK L. KARTHEISER, chief clerk, mechanical department, of the Chicago, Burlington & Quincy, has been appointed assistant to vice-president (operation), with headquarters at Chicago, as announced in the October issue of the *Railway Mechanical Engineer*. Mr. Kartheiser was born at Aurora, Ill., on April 19, 1893, and studied engineering. He entered railway service in 1910 as a timekeeper on the Burlington at Aurora, later serving successively as a dispatcher's clerk and clerk and secretary in the office of the superintendent of motive power at Chicago. During World War I he attended the Officers' Training School of the U. S. Naval Reserve and later served as an ensign. In 1919, he served with the U. S. Railroad Administration at Chicago and in 1920 returned to the Burlington, being assigned to mechanical statistical analysis. In 1923 Mr. Kartheiser was promoted to the position of chief clerk to the superintendent of motive power and from 1928 to 1936 was A. A. R. mechanical inspector. He became chief clerk to the mechanical assistant to the executive vice-president in 1936. Mr. Kartheiser has been secretary-treasurer of the Car Department Officers' Association since 1937 and was president of the Car Foremen's Association of Chicago 1933-34.

Frank L. Kartheiser

Master Mechanics and Road Foremen

K. G. CARNES has been appointed road foreman of engines of the Southern, with headquarters at Spencer, N. C.

J. C. FIELDS, fireman of the Pocahontas division of the Norfolk & Western, has become assistant road foreman of engines.

T. C. CORY has been appointed master mechanic of the Western division of the Texas & Pacific, with headquarters at Ft. Worth, Tex.

G. C. BOGART, assistant master mechanic of the Southern Pacific at West Oakland, Calif., has been appointed master mechanic of the San Joaquin division, with headquarters at Bakersfield, Calif.

GOMER D. JONES, erecting foreman of the Topeka, Kan., shops of the Atchison, Topeka & Santa Fe, who has been appointed to fill the newly created position of master mechanic of the Southern Kansas division, with headquarters at Chanute, Kan., as announced in the October issue, was born on May 28, 1902, at Williamsburg, Iowa. He received the degree of B.S. in mechanical engineering from Iowa State College in 1924. In June, 1923, he entered the service of the Santa Fe as a special apprentice in the locomotive department. In April, 1927, he became a machinist at the Topeka shops; on May 21, 1927, test department assistant; in October, 1935, assistant to engineer of tests; in August, 1939, system mechanical inspector, and in January, 1942, erecting foreman, Topeka shops.

Car Department

J. M. NICKISHER, general car inspector of the Lehigh Valley, with headquarters at Sayre, Pa., has been appointed superintendent car department at Bethlehem, Pa.

G. A. WATERS, division car foreman of the Erie at Meadville, Pa., has retired.

S. C. LUND has been appointed division car foreman of the Erie with headquarters at Meadville, Pa.

H. F. LYONS, general car inspector of the Reading at Philadelphia, Pa., has been appointed acting superintendent car department.

Shop and Enginehouse

SHERMAN OSCAR RENTSCHLER, general foreman in the locomotive department of the Missouri Pacific at Sedalia, Mo., who has been appointed superintendent of shops, with headquarters at Sedalia, as announced in the October issue, was born on October 12, 1904, at Verdon, Neb. He attended

S. O. Rentschler

high school from 1914 to 1918 and entered the employ of the Missouri Pacific on September 19, 1923, and served as a machinist apprentice and machinist at Fall City, Neb., until April 28, 1929, when he became division foreman and enginehouse foreman at St. Joseph, Mo. He subsequently served as division foreman and enginehouse foreman at Omaha, Neb., and Lincoln; Wichita, Kans., Osawatomie and Hoisington; Kansas City, Mo., and St. Louis, and was appointed general foreman at Sedalia on April 1, 1939.

H. H. HICKS has been appointed locomotive foreman of the Canadian National, with headquarters at Mimico, Ont.

L. R. GABLE, assistant enginehouse foreman of the Norfolk & Western at Portsmouth, Ohio, has retired.

AMIL J. BENNIE, shop inspector of the Norfolk & Western, has become assistant foreman of the erecting shop at Portsmouth, Ohio.

IRA O. DIDDLE, assistant foreman in the erecting shop of the Norfolk & Western, Portsmouth, Ohio, has been appointed assistant enginehouse foreman.

ALEXANDER H. MITCHELL, superintendent of shops of the Lehigh Valley at Sayre, Pa., has been appointed superintendent system shops and enginehouse, with headquarters at Sayre.

W. C. BOWRA, locomotive foreman of the Canadian National at Mimico, Ont., has been appointed locomotive foreman, with headquarters at Turco, Que.

E. K. ROGERS, a machinist in the employ of the Chesapeake & Ohio, has been promoted to the position of assistant enginehouse foreman at Hinton, W. Va.

Purchasing and Stores

WILLIAM C. ATHERTON, purchasing agent of the Pere Marquette, with headquarters at Cleveland, Ohio, retired on October 1 after fifty years of continuous railroad service. Mr. Atherton was born on July 3, 1872, and entered railway service in 1892 as clerk in the stores and mechanical departments of the Baltimore & Ohio. He was promoted to the position of division storekeeper, at Willard, Ohio, in 1894 and served subsequently as a clerk in the motive-power departments of the Elgin, Joliet & Eastern; the Chicago & Western Michigan (now part of the Pere Marquette); the Chicago, Peoria & St. Louis (later sold to various roads and partially abandoned); and the St. Louis, Peoria & Northern (now divided between the Illinois Central and the Alton). He was appointed general storekeeper of the Chicago & Eastern Illinois, at Danville, Ill., in 1900, and in 1903 went with the Pere Marquette as general storekeeper. Mr. Atherton became general storekeeper and fuel agent in 1905, and purchasing agent in 1908.

Obituary

TIMOTHY B. ROBERTS, supervisor of apprentices of the Lehigh Valley, who died after a short illness on October 14, 1942, was 56 years old. He was born in Wellsboro, Pa. Mr. Roberts entered the service of the Lehigh Valley as a call boy at the age of 14. He became a machinist apprentice at Sayre in 1905, and after his apprenticeship was employed in the Sayre shops as a machinist for 11 years. In June, 1918, he was made a foreman and in August, 1924, a piecework inspector, continuing in that capacity until February, 1930, when he became supervisor of apprentices. Except for an interval of three years he remained in that capacity until his death.

G. L. LAMBETH, superintendent of motive power of the Gulf, Mobile & Ohio, with headquarters at Jackson, Tenn., died on October 5 after a short illness. Mr. Lambeth was born in Lynchburg, Va., in 1875 and entered railway service in 1894 as a machinist apprentice in the employ of the Southern. In 1910 he went with the Mobile & Ohio (now part of the Gulf, Mobile & Ohio) as master mechanic and on March 20, 1920, he was appointed to the position of superintendent of motive power and car equipment, with headquarters at Mobile, Ala. Three months later, he was transferred to St. Louis, Mo., and later to Jackson. When the Gulf, Mobile & Northern and the Mobile & Ohio were consolidated into one system—the Gulf, Mobile & Ohio—Mr. Lambeth continued at Jackson as superintendent of motive power.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

FACE-MILLING OF STEEL.—Firth-Sterling Steel Company, McKeesport, Pa. Engineering Bulletin No. FE-106, "Hyper-Milling," describes and illustrates a new method for the face-milling of steel with Firthite-tipped cutters.

◆

MACHINE TOOLS.—The Cincinnati Planer Company, Cincinnati, Ohio. Thirty-two-page Bulletin No. 52. Specifications and illustrations of Cincinnati Hypro double housing planers, open-side planers, planer type millers, and vertical boring mills.

◆

PRESS BRAKES.—The Cincinnati Shaper Co., Cincinnati, Ohio. Sixty-four page, spiral-bound booklet, Catalog B-1. Illustrates press-brake applications, bending and punching load charts, features for special work, and dies and their uses.

◆

DEODORANT.—Oakite Products, Inc., Room 1002, Wrigley building, Chicago. Sixteen-page illustrated booklet on Oakite Deodorant No. 1, a sanitation material for cleaning, deodorizing, and disinfecting, in one operation, passenger cars, repair shop washrooms, locker rooms, etc.

◆

BEARING LUBRICATION.—SKF Industries, Inc., Front street and Erie avenue, Philadelphia, Pa. Thirty-two-page booklet, "A Guide to Better Bearing Lubrication." Designs, formulae, and graphs aid in explaining highly technical text on the practical problems of correct ball- and roller-bearing lubrication.

◆

UNIT HEATER.—Wilson Engineering Corporation, Chicago. Bulletin B-2 describes and illustrates the Wilson unit heater, now constructed with a non-critical all-cast-iron core in place of war-critical aluminum and copper, for use in railway shops, engine terminals, storehouses, etc. Specification drawings show dimensions and capacities of the available sizes. Last page illustrates the Wilson cast-grid radiation elements for cooling and de-humidifying compressed air on locomotives.

◆

STRESS-STRAIN RECORDING. — Baldwin Southwark Division of the Baldwin Locomotive Works, Philadelphia, Pa. Twenty-two-page illustrated booklet, No. 162, "Automatic Stress-Strain Recording," in four parts: Part 1, application of the recorder to Army and Navy specification testing; Part 2, interpretation of the stress-strain curve; Part 3, description of the recorder and accessory extensometers; Part 4, condensed comment on operation and maintenance.

AVOID this Costly Valve Leakage

AREA OF LEAK	AIR		STEAM		WATER	
Diameter Inches	Number of cubic feet per month at 75 lb. pressure	Total cost of waste per month 11c per 1000 cubic feet	Pounds wasted per month at 160 lb. pressure	Total cost of waste per month 65c per 1000 lb.	Gallons wasted per month at 60 lb. pressure	Total cost of waste per month 16c per 1000 gallons
1/2"	13,468,000	$1,481.44	1,219,280	$792.53	1,524,100	$243.86
3/8"	7,558,500	831.44	684,290	444.79	855,360	136.86
1/4"	3,366,990	370.37	304,820	198.13	381,020	60.96
1/8"	824,570	90.70	74,650	48.52	93,310	14.93
1/16"	213,000	23.43	19,280	12.53	24,110	3.80
1/32"	52,910	5.82	4,790	3.11	5,990	.96

Enlarged copies of this chart printed on cardboard are available on request; also ask for Lunkenheimer Catalog 78.

Valves aren't so easy to replace these days . . . practically all materials going into their manufacture are on the critical list. This means that it is up to every valve user to take the best care of what he has to insure the longest possible service life.

Leaky valves are saboteurs of your production schedules . . . obstructing your best efforts and increasing your costs. The chart illustrated above gives you an idea of what valve leakage costs you.

Fortunately, valves respond to good treatment. Careful handling, immediate repair of the slightest leaks, and prompt replacements of worn parts will keep them on the job, ready to meet the demands imposed by industry's unprecedented war effort.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" symbols on their orders. This will be of mutual helpfulness.

ESTABLISHED 1862

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